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Making Chasers for Self-Opening Dies

Milling Chaser Blocks to Form and Size—Cutting the Threads by Means of Hobs—Chasers Must Be Interchangeable—Hand and Machine Lapping Methods

SPECIAL CORRESPONDENCE

THE automatic or self-opening die, which is an indispensable tool in practically all manufacturing operations involving the cutting of screw threads in duplicate and without which no screw machine equipment would be considered complete, is the logical development of the old time "jam-plate" that might have been found in the toolkit of any toolmaker or machinist of forty years ago.

This old-fashioned jam-plate was usually in the form of a rectangular frame, with suitable handles, adapted to hold different sizes of threading dies, each die made in two parts one of which remained in a fixed position while the other was adjustable by means of a backing screw to suit various diameters of work.

The jam-plate was well named. Though each die had four cutting edges, but two of them could possibly be brought into action on any but the nominal size of the screw for which the die was intended and, owing to the wringing motion imparted to the die in conjunction with the continual advancing of the backing screw, a thread was "jammed" rather than cut into the material.

Notwithstanding its unreliability and the uncertain character of its product the jam-plate possessed two distinctive features in common with the self-opening die; it was adaptable to slightly varying diameters of screw, and it could be opened to remove the work without "unscrewing" it.

Like its predecessor, the self-opening die is usually supplied with four cutting edges, or chasers, but unlike the jam-plate the cutting edges are all advanced toward the center of the work in unison and are thus all in position to take an equal share of the cutting, regardless of the adjustment of the die.

Evolution of Self-Opening Die

In the process of evolution through which it has passed the self-opening die has developed from an uncertain, unreliable tool to a perfection that enables it to produce with unfailing regularity hundreds of thousands of duplicate threads of every known thread characteristic and in sizes from the tiny No. 0 machine screw to sturdy bars 3 in. in diameter. Thread forms from a standard V of 56 pitch to square or Acme threads of 2 per inch are regularly cut, to a degree of accuracy that compares favorably with similar threads generated by means of leadscrew and single point tool and at a rate with which no other method can be compared.

Though the die-head itself is a piece of mechanism that involves the most careful design and accurate workmanship, the practicability of the automatic die as a production tool is dependent upon the accuracy and interchangeability of the chasers which do the actual cutting and which must be renewed from time to time as they become worn in service. The chaser department of the Eastern Machine Screw Corporation, New Haven, Conn., where the material for this article was obtained, is a highly organized manufacturing establishment for the production of these chasers in large quantities, though giving to each chaser the attention ordinarily devoted to the making of a single tool.

All chasers made by this firm are of high-speed steel Though there are doubtless occasional instances where other kinds of steel might be expected to possess advantages for the purpose, this idea is probably due rather to the difficulty experienced in handling it than to any characteristic of the steel itself. Properly finished chasers of high-speed steel have been found to give superior results, regardless of the nature of the material to be threaded.

Raw Stock Is Cold Drawn Bars

The stock is received at the factory in the form of cold-drawn bars of rectangular section, conforming in size very closely to the finished dimensions of the chasers so that no machining operations other than grinding are required to bring them to size. All chasers except specials are put through upon shop orders, the number of chasers in each lot depending upon the estimated demand for a given size.

Sawing machines are arranged to handle any number of bars up to twenty-four, according to size. The blanks, as the cut sections are called, pass to the Pratt & Whitney vertical spindle grinding machine shown in Fig. 1 where a sufficient number to cover the surface is laid upon a magnetic chuck and one wide side ground to a true surface. They are then stood up edgewise between parallels and ground upon one edge. These operations are repeated upon the same machine at a later stage, at which time the chasers are practically completed and hardened.

Passing next to the milling machine shown in Fig. 2, where the blanks are held four at a time in a special cam-operated vise, a square sectioned slot is milled diagonally across one of the wide faces and at the same time a part of one end is milled parallel to the slot. A gang of cutters of the proper relative diameters complete these cuts upon the four pieces at one pass.

Minor operations follow, including the drilling of a small hole in each block through which a wire is passed in the later operation of hardening to hold each set of four chasers together, milling off the corners so that no unnecessary sharp edges need be presented, removing burs that may have been thrown up by previous milling operations, etc. The blanks go thence to the stamping bench, Fig. 3, where each group of four blanks receives a serial number and each member of every group of four

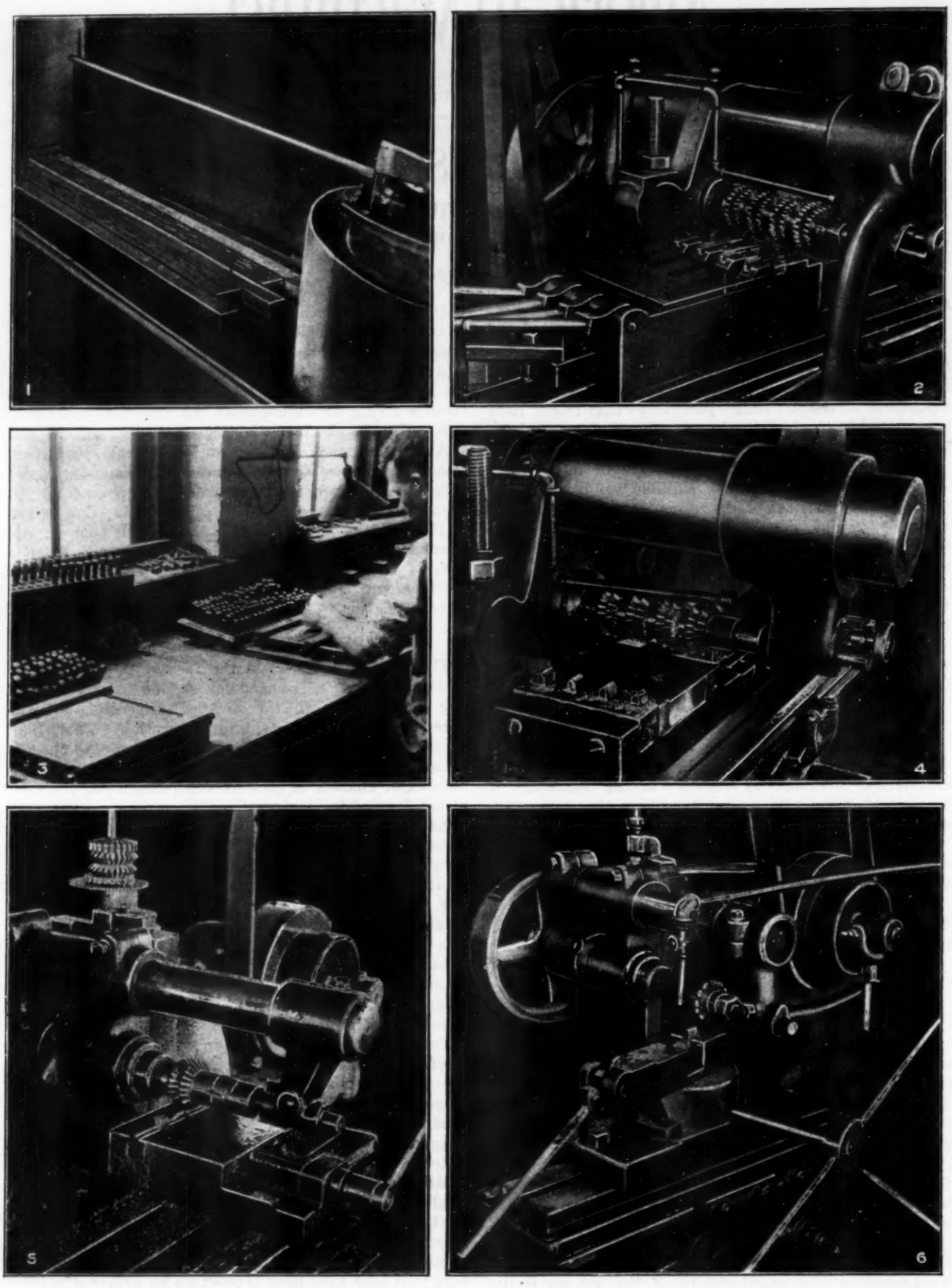
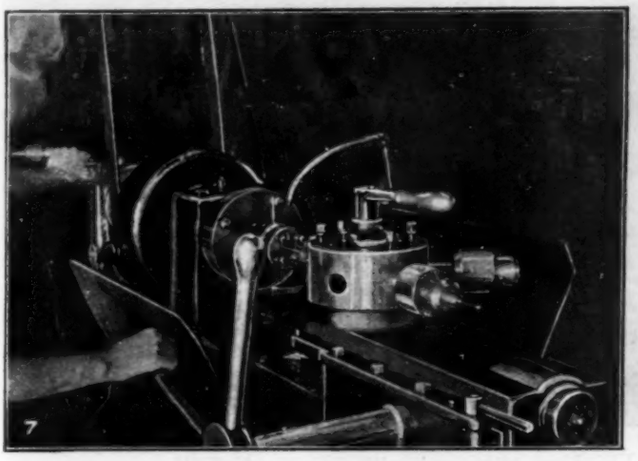


FIG. 1—CHASERS ARE GROUND ON SIDES AND EDGES BOTH BEFORE AND AFTER HARDENING. FIG. 2—MILLING THE CAM SLOT; THE STARTING POINT. FIG. 3—STAMPING THE CHASERS WITH SERIAL AND SET NUMBERS
FIG. 4—POINTING, OR MILLING TO LENGTH. FIG. 5—MILLING INDIVIDUAL CHASERS TO LENGTH
FIG. 6—MILLING THE RADIUS AT CUTTING END

is stamped 1, 2, 3 or 4, to denote the position it is to occupy in the die-head. Such a group constitutes a "set" and is handled as such in all succeeding operations having to do with the length of the chaser.

The next operation is called "milling to length," though the absolute length of the chaser is not established at this time. In this operation, as in all others involving length, the chasers are located from the diagonal slot. This is the "cam slot" that determines the radial position of the finished chaser in the die-head.



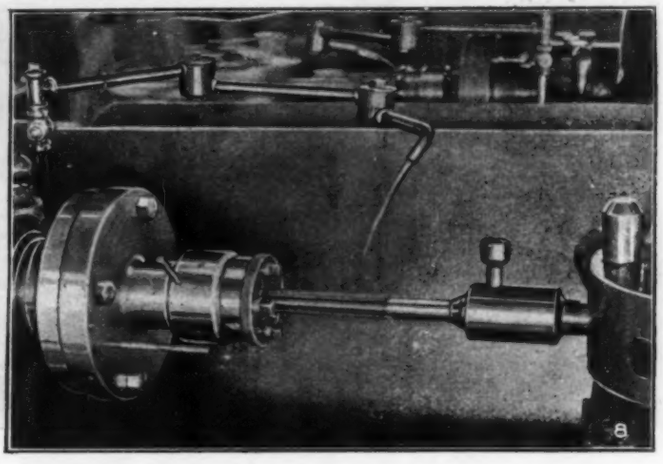


FIG. 7—HOBBING THE CHASERS. FIG. 8—THE WAY THE HOBS ARE HELD

As may be seen in Fig. 4, the chasers are again held four at a time in accordance with the serial number of the group, so that each loading constitutes a "set," and as they are milled in one pass they must necessarily correspond in length, though one set may vary from another in this respect if desired.

As the foregoing operation is one that must be performed upon "special" sets as well as upon the regular product an additional means of doing it, shown in Fig. 5, is provided. As it is always small lots that come to this machine no multiple holding fixture has been made but the manner of locating the piece by means of a rib upon the vise jaw fitting into the cam slot is the same as in the larger fixture.

The operation of milling the end of the chaser to a radius conforming to the root diameter of the screw to be produced by the die is shown in Fig. 6. An ingenious method of producing grooves of many different radii without the use of a corresponding number of milling cutters is here employed. Round faced cutters are used, and if the required radius is the same as that of the cutter face the work is passed under the cutter in a direction at right-angles to the axis of rotation. If a larger radius is needed the fixture is swung to pass the work obliquely under the cutter; the resulting radius increasing as the angle of departure increases.

Strictly speaking the resultant is no part of a true circle but is elliptical in shape. For the reason, however, that the final curvature of this part of the chaser is the product of the hob in a later operation, the departure from a true circular arc is so slight as to be negligible.

After passing an inspection test to make certain that no error in length has been allowed to creep in, the blanks go to the hobbing operation, of which Figs. 7 and 8 will serve to convey an idea. Before describing the manner in which the hobbing is done a word will be said as to the importance of the hobs themselves.

The cutting teeth of all chasers are the product of some form of hob. For every slight variation in diameter, in form, or in pitch, there must be a set of hobs to correspond. This is true even if but one set of chasers is to be made, and, as there must be from two to five or six hobs in a set, depending upon the size and shape of thread section and relative diameter, this will serve to explain why the cost of special chasers, however slight the departure, may seem out of all proportion to that of standard chasers.

The number of hobs required depends upon the size and shape of thread section and relative diameter of the screw to be produced. Chasers for a screw of large diameter having a fine pitched (and consequently shallow) thread of single lead could probably he cut with a single hob. On the other hand a screw of small diameter and relatively large thread section, particularly if of double or triple lead, might require half a dozen.

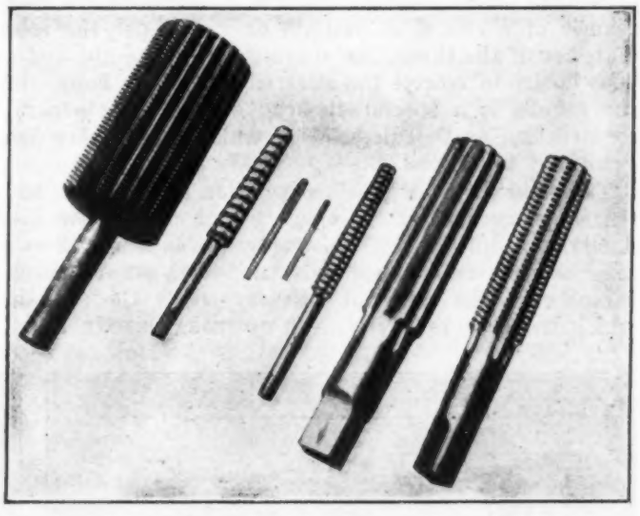


FIG. 9—VARIOUS SIZES AND FORMS OF HOBS

In Fig. 9 are shown some examples of the hobs required. The one at the left is of large diameter with a fine thread and is able, unassisted, to take care of all the work that comes to it. The second one is an Acme double thread of relatively small root diameter and probably requires three or four smaller hobs to precede it, as it could not possibly stand to remove the required amount of metal from the solid at a single pass.

Though the making of the hobs involves none but

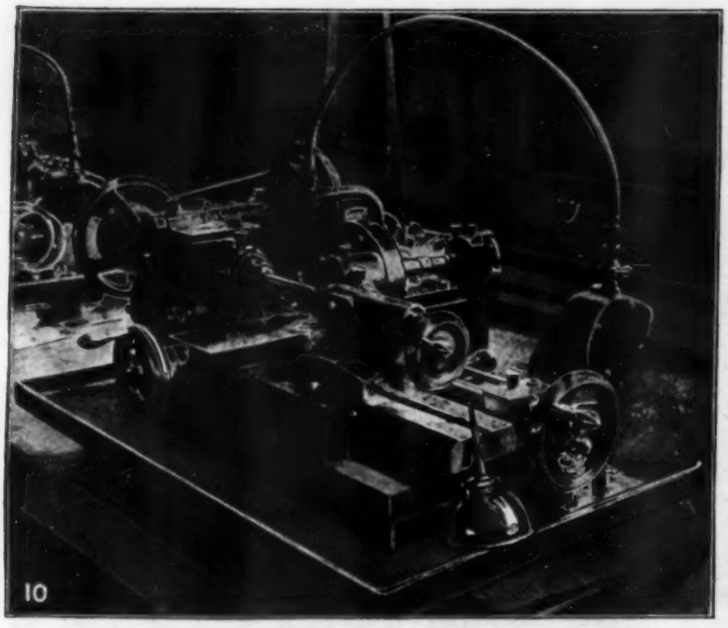


FIG. 10—MILLING THREADS ON THE HOBS.

FIG. 11—GAGING AND FILING TO LENGTH

well-known machining processes, most of them being made upon Waltham thread milling machines one of which is shown in Fig. 10, the designing, particularly of special forms where the designer must make his deductions from previous experience, calls for careful study.

Returning to a consideration of the actual hobbing operations, Figs. 7 and 8 show the set up. In the turret of a hand screw machine there is a chuck with a rose reamer of a size a thousandth or two under the root diameter of the thread to be produced by the die, and a float holder to receive the squared end of the hobs. In the spindle is a special die-head of the same general construction as the die-head in which the chasers are eventually to be used.

The same cams are used to position the chasers, and the same mechanism for opening and closing the die. A slight modification of the front plate is made, as this must be removed and replaced each time a set of chasers is hobbed. The essential difference is in the slots in which the chasers lie; instead of being exactly radial they are inclined slightly backward, with the result that the heel of the chaser is brought closer by a very small amount to the center of rotation.

With a set of chasers in place, Nos. 1, 2, 3 and 4 in their respective slots, the rose reamer is run through, leaving a round true hole of the correct diameter. The operator then introduces No. 1 of the set of hobs and brings up the float holder, which serves exactly the same purpose as a tap wrench.

With the machine revolving very slowly and with a flood of oil on the hob, the latter is run through the die, the operator merely following the movement with the turret. The die is then thrown open and the hob removed, the die closed and No. 2 run through in the same manner; other hobs follow in the same way if there are more in the set.

The operation is very quickly performed and there is nothing to go wrong. Every contingency has been provided for in the design of the tools. The slight inclination of the slots in the die-head, previously referred

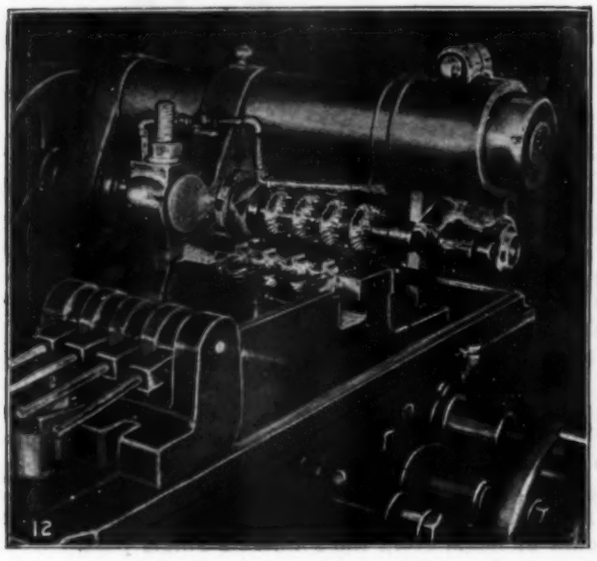


FIG. 12—MILLING CUTTING EDGE AND BEVELING HEEL.

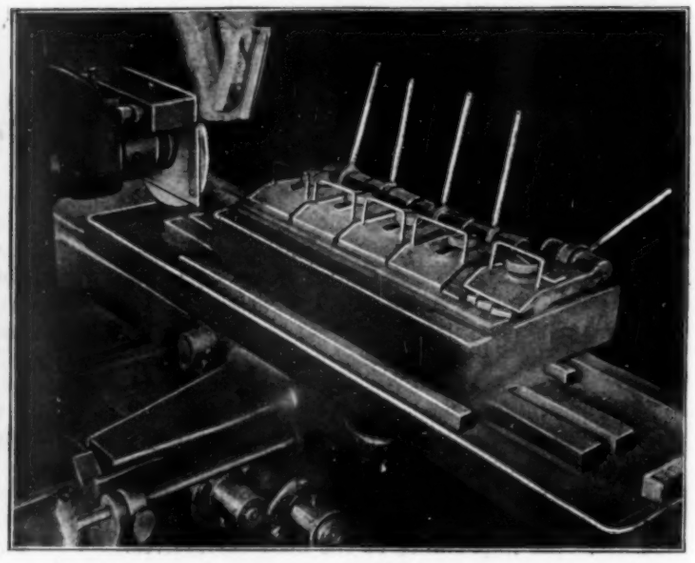


FIG. 13—GRINDING THE CUTTING EDGE

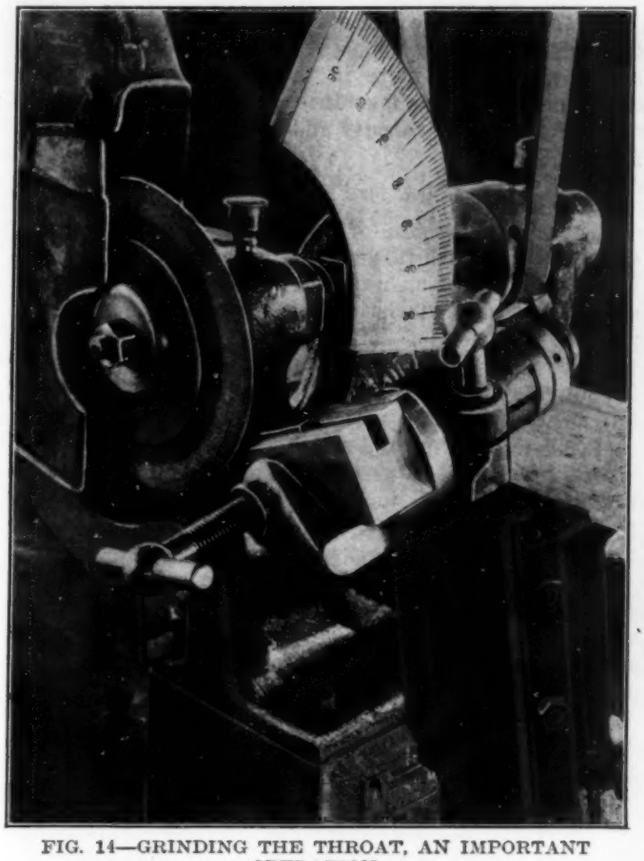


FIG. 14—GRINDING THE THROAT, AN IMPORTANT OPERATION

to, provides the necessary clearance to the die, and the manner of holding the hobs insures that they will go through correctly. As the hobs are started by the operator's fingers there is no possibility of getting a following hob in wrong. A green operator could be trained to the work in a few hours time.

After hobbing, the chasers are sent to the inspecting room where the newly formed threads are carefully scrutinized to make certain that no imperfections are getting by because of unnoticed defects in the hobs.

Testing the chasers for length, as shown in Fig. 11, is the next operation. In the device shown before the operator there is a pair of jaws so designed as to grip each chaser flatwise, locating it, as in the other fixtures, by the cam slot. The slide is then pushed forward until it contacts with a fixed stop in which position the pointed end of the measuring spindle has entered the thread and been forced back by it far enough to cause a rotation of the pointer on the dial indicator.

Holding the slide against the stop the operator turns the dial to bring the zero mark under the pointer, after which he tries the remaining three chasers of the same set. It is not essential that all sets should be alike but there must be no variation between the four chasers of any one set.

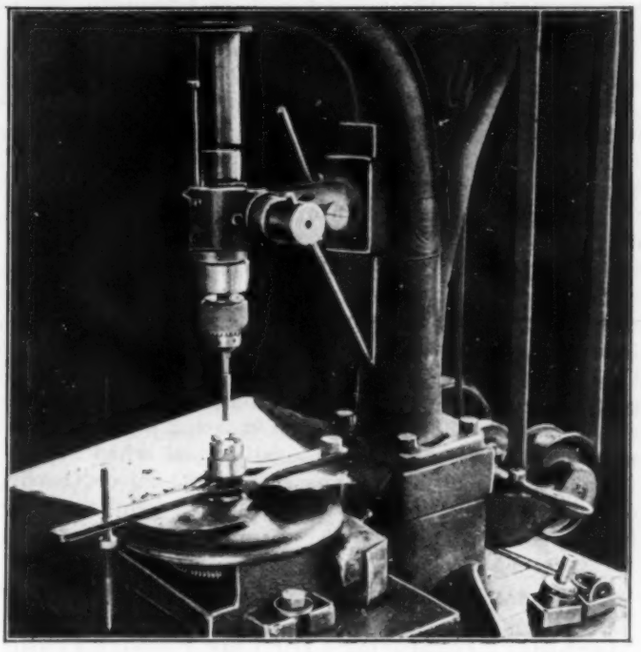


FIG. 16—MACHINE LAPPING THE SMALLER CHASERS

If the operator finds variation in this respect he picks out and lays aside the shortest one, after which he places the others successively in the little machine to his right and files a slight amount off the bearing side of the cam slot. By repeated filing and gaging he is enabled to bring a set of chasers very quickly to a uniform length.

Up to this time the cutting end of the chaser is beveled, both front and rear, this shape remaining from the pointing or "milling to length" operation shown in Fig. 4. To make a free cutting tool the edge of the chaser must be beveled slightly in the other direction to establish a certain degree of top rake. To do this they are sent back to the milling department where, as shown in Fig. 12, they are loaded into a fixture and milled to the shape that is retained in the finished chaser. To remove the burrs that are thrown into the teeth by the mills the chasers are then sent to the grinding machine shown in Fig. 13 and ground upon the edge. This operation is later repeated, using the same machine and fixture, after the chasers are hardened.

The chasers are now ready for the hardening operation. The utility of the small crosshole drilled in each chaser at an earlier stage is here made apparent. Chasers might be hardened without reference to their

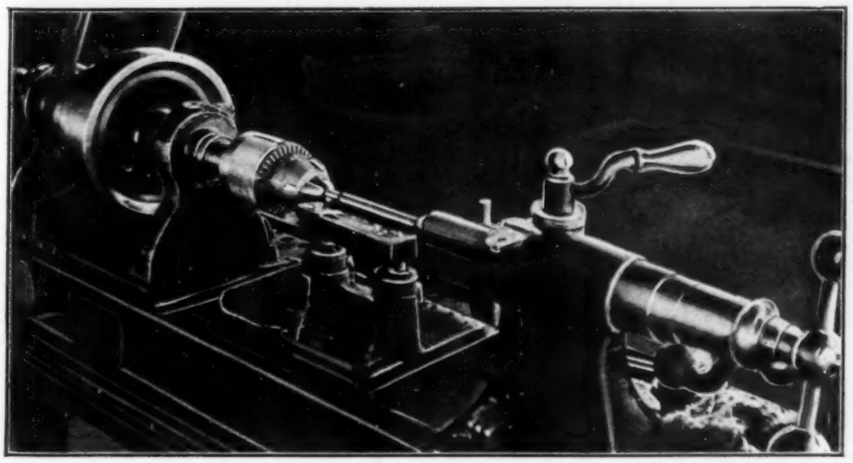


FIG. 15—THE SET-UP FOR HAND LAPPING

position as members of a set and good results obtained, but if there should be any variation in treatment there would inevitably be chasers of different degrees of hardness in many of the sets. To eliminate the possibility each set is wired together and treated in its passage through the hardening room as one piece.

After hardening, the chasers are pickled, sand-blasted, inspected and tested for hardness. They are then finish ground upon flats and edges on the same machine and in the same way as was illustrated in Fig. 1. They are also reground on the cutting edge as previously mentioned in connection with Fig. 13.

Grinding the Throat

What is perhaps the most delicate operation in the manufacture of chasers is the grinding of the throat. Practically all of the work performed by a screw cutting die in removing metal falls upon the two or three more or less stubbed teeth of this beveled off portion of the die and if the angles are not just right or the teeth not properly formed the die will work badly.

The essential parts of the machine shown in Fig. 14 were designed and constructed at the factory where it is in use. By means of the various adjustable features the chaser to be ground may be presented to and swung past the grinding wheel at any predetermined angle in either plane. Though somewhat complex in design the machine is very simple in operation and when set up for the style and size of chaser in hand an ordinarily conscientious operator may grind them indefinitely with little opportunity for error.

The secret of the successful production of millions of parts necessarily so accurate as the chasers of an automatic die lies more in the machines than in the operators. Make the machines so they cannot go wrong and the desired uniformity and accuracy of product will follow.

Lapping the Finished Piece

The final operation of the chasers is the lapping. On the larger sizes this is done by hand, Fig. 15 showing the simple set-up required. A lap of the same size and thread characteristics as the screw the die is to produce is made of soft steel by the same accurate methods as are employed in making the hobs. The lap is rotated at a comparatively high speed and the chaser, laid flatwise upon a rest that is carefully adjusted to the correct height, is passed over it by hand. A fine abrasive, floated in oil, is used, being applied to the lap with a brush. This is a job requiring skill and experience to do nicely, but once having acquired the knack the production is surprisingly rapid.

To lap the smaller sizes of chaser a small drill press has been fitted up as shown in Fig. 16. In this machine a die-head, constructed in the same manner as the heads used in the hobbing operation, is mounted upon the upper end of a short vertical spindle that may be slowly rotated by means of the worm and worm wheel. The lap, rotated by the drill press spindle, is passed repeatedly through the closed die, the die-head being opened after each pass in order to permit the lap to be withdrawn.

Machinery Quotations for Our Export Trade

By Frank W. Wearin

The writer recognizes that a number of articles have been written from time to time concerning our export trade, and that various factors must be observed to maintain what trade we have and to stimulate it to a further degree. However, I think that each factor has not been emphasized sufficiently to give us a definite idea of the situation.

A concern engaged in exporting machinery to various parts of the world receives inquiries which seldom give sufficient information for it to judge what is really required. The best way out of the difficulty is for the manufacturer to quote the cost of a small or medium sized machine, and to give the full particulars regarding the number of cases, their weights, and the three dimensions of each case. The exporter may then calculate the freight charges to the prospective destination.

Descriptive circulars should be furnished, giving complete details of the construction of the machine and its production capacity for a given time under normal conditions. The machine quoted on may not be what the client requires, but he will be able to judge from the data received what he really needs, and his reply will give something tangible on which to base the next quotation.

It is practically a waste of time to forward a quotation that is incomplete in detail, more especially if it is going to a client in the middle of Africa, India, or Australia, or even to places that are nearer our shores. It must be borne in mind that very few clients have any idea of the freight rates between a port in the United States and their nearest point of delivery. These details should include also the marine and war insurance.

It is folly to quote f.o.b. at some internal point, say Chicago or Indianapolis, and expect your client in Burma to calculate freight and insurance to his port, without a knowledge of the forwarding agents' charges. Always quote "Free on Board Ship; Freight and Insurance Paid," unless a branch office on the U. S. seaboard is to handle the shipment.

The safe and substantial boxing of a shipment is vitally important for its safe carriage to its destination, and I regret to remark that this is a factor of the export business that has been shamefully neglected in the past. Many manufacturers leave the boxing of machinery to the shop foreman, or to the shipping department in which they have a very small interest. Sometimes a draftsman is sent to make a sketch of a machine crate, which is handed to the shipping department, without receiving the approval of an executive. The shipping department boxes the machine as per sketch, then hoists it in a box car labelled for New York.

If the machine arrives in New York in a broken condition the consignee ships it back to the factory for repairs. But if it is damaged at some further point in transit, there is a long argument betwen the client, the exporter and the factory, as to who is to pay the extra repair charges. The draftsman who designed the box and the shipping department that sent out the box are not to blame, but rather the careless executive who should have shouldered the responsibility. All these undesirable boxing factors can be obviated if some executive would devote a little serious thought to this important export item.

Machining and Assembling Operations on Pneumatic Tools

The Last of Four Articles—Boring and Reaming Air Motor Cylinders—Setting the Valves—"Running-in" the Motors—The Testing Brake

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

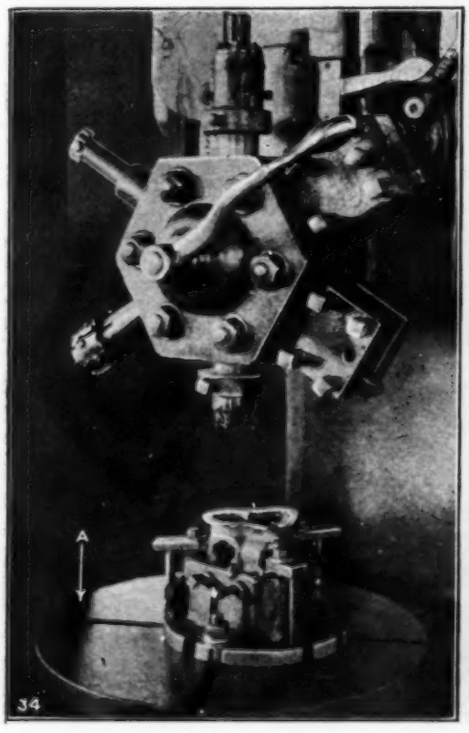
THE operation of boring out the ends of the cylinders for a four-cylinder air motor at the Aurora plant of the Independent Pneumatic Tool Co. is shown in Fig. 34. The piece is held in a fixture that is bolted to a supplementary table *A* on the table of the machine. The supplementary table holds two dowel pins, one considerably larger than the other, and the bottom of the fixture contains eight bushed holes, four for each pin. The bottom of the fixture can be seen in Fig. 35, the two dowel pins being shown at *A*. As the different boring and facing operations are performed, the fixture is shifted, locating on one set of pins for each operation. When one of the larger holes is slipped over the large dowel pin, the corresponding small hole will fit over the small dowel pin, which brings the piece into the correct position for machining one section of the case. Four operations are performed with this fixture.

The operation of finish-reaming the cylinders of a four-cylinder air motor on a Becker-Brainerd vertical milling machine is shown in Fig. 36. The motor case is bolted to the indexing bracket *A*, that can be swung so as to bring the opposite set of cylinders in line with the spindle, using the handle *B* at the rear. Correct location is obtained by means of a pin in the back of the fixture, that slips into either one of two holes in the indexing bracket *A*, according to which set of cylinders is being reamed. The handle *C* is used to slide the whole fixture so that both front and rear cylinders of each pair can be reamed. The base to which the fixture is attached slides on ways on the sub-base, thus keeping the fixture in line with the spindle of the machine.

In Fig. 37 the same operation can be seen with the opposite pair of cylinders in line for reaming.

The valves of an air motor have to be set or timed, just as do the valves in any other kind of a motor. A very interesting device is used for this operation; it is shown in Fig. 38. The dial *A*, which is graduated by degrees, is placed over the end of the crankshaft, and the finger *B* is attached to the end of the shaft. This finger indicates the exact location of the shaft as the interior mechanism is rotated. The electrical device *C* is plugged into the cylinder head of the machine and when the piston is at the top of the cylinder, a connection is made which lights an electric bulb, thus apprising the operator of the location of the piston so that the valves can be set accordingly. The upper connection in part *C* connects with the piston and the lower connection connects with another light which apprises the operator of the opening of the valve. The connection with the air line is made while this timing process is going on, and the lower connection contains a small hole through which a blast of air rushes at the instant the valve begins to open, blowing a small copper hinge, to which one wire is connected, against the piece to which the other wire is connected, thus forming a connection and lighting the incandescent lamp. This valve has to open just a certain number of degrees before the piston is at the top of the cylinder, and if these lamps do not light at exactly the proper times the valves are adjusted.

All air motors, after they have been assembled and the valves adjusted, are subjected to a running-in operation on frames similar to those shown in the illustration, Fig. 39. This is done in order to loosen up the bearings and pistons and be sure that all parts are in a high-class operating condition. Those shown in this illustration are the "close



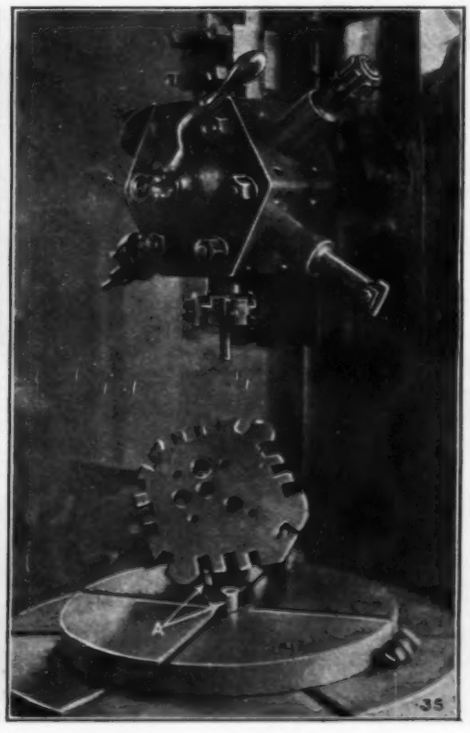
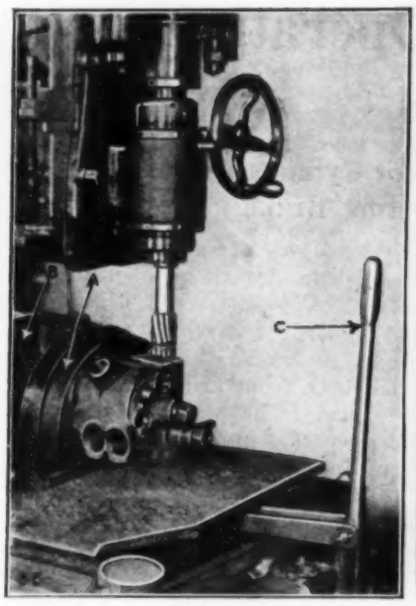


FIG. 34—BORING AIR MOTOR CYLINDERS. FIG. 35—METHOD OF LOCATING THE FIXTURE



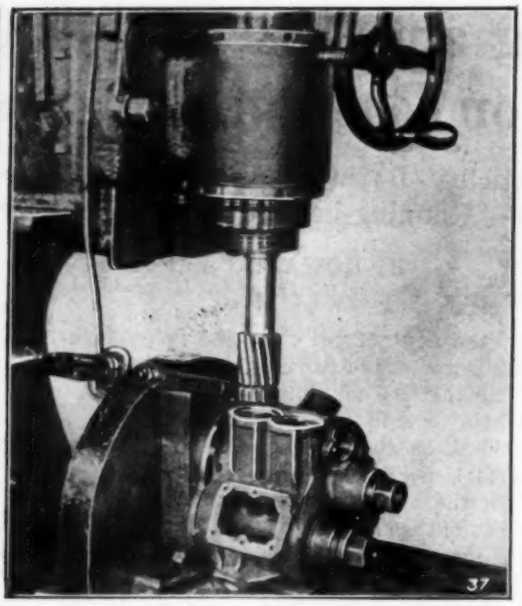


FIG. 36—FINISH REAMING AIR MOTOR CYLINDERS. FIG. 37—SHOWING OPERATION OF REAMING FIXTURE

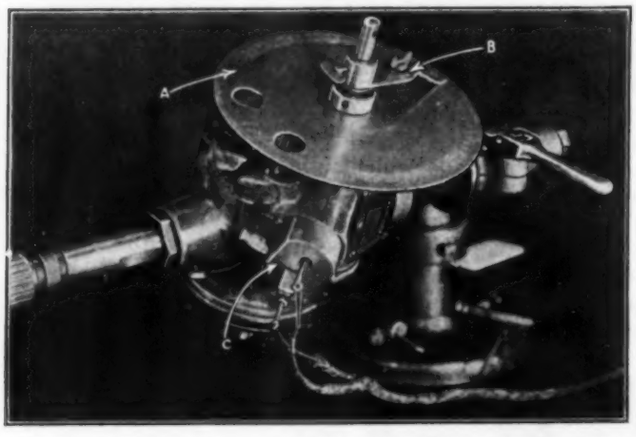
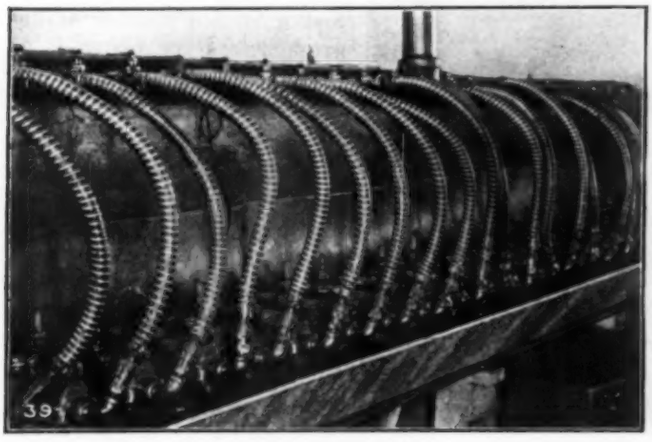


FIG. 38—APPARATUS FOR TIMING VALVES

quarter" motors, while those shown in Fig. 40 are the more commonly known standard type. The "close quarter" motors are connected to the air line separately, while those shown in Fig. 40 are connected together through an ingenious device. Each frame carries four air motors, one of which is connected with the air supply and does the driving, while the other three are driven through chain and sprocket connections. The fact that any one of the air motors is driven instead of being the driver in this running-in test does not detract from the value of the operation. Each motor is mounted in the frame in a manner corresponding to that in which it will be used in service. In this case the sleeve is held in a bearing in the frame while the other end is supported by an "old man" as shown in the illustration. The valve heads are removed from the other three motors; otherwise they would be acting as compressors while the running-in operation was proceeding.

The torque of an air motor is a very important feature, as it indicates the ability of the motor to pull a drill at the rated capacity. The arrangement used for testing the torque of a "close quarter" air motor is shown in Fig. 41. The tank *A* supplies oil to the disk clutch *B* from the top of which projects a taper which fits into the drill spindle of the motor. A ratchet wrench is applied to the back center *C* so that pressure may be applied to the clutch. A scale *D* is now arranged between the support *E* and the air connections to the motor, and the air is turned on. As the motor is fed downward by the action of the ratchet, the oil is squeezed out from between the clutch plates and the pull on the scale becomes stronger. Any motor which fails to pull the specified capacity is sent back to the assembly room and examined for defective parts.

The apparatus shown in Fig. 42 is a testing brake, used to determine the pulling capacity of an air motor. The motor is mounted in a standard frame, as shown, with the drill socket connected with the shaft of the brake. This brake consists of a metal drum *A* about which the tension rope *B* is wound, the latter being attached at each end to a spring balance so that the



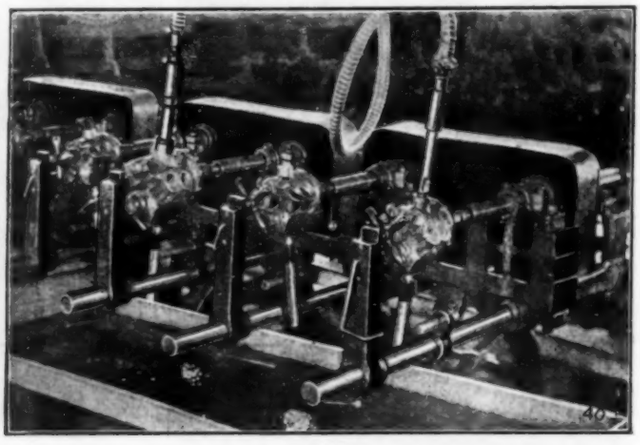


FIG. 39—RUNNING-IN STANDS FOR "CLOSE QUARTER" DRILLS. FIG. 40—ONE MOTOR DRIVING THREE OTHERS ON A RUNNING-IN STAND

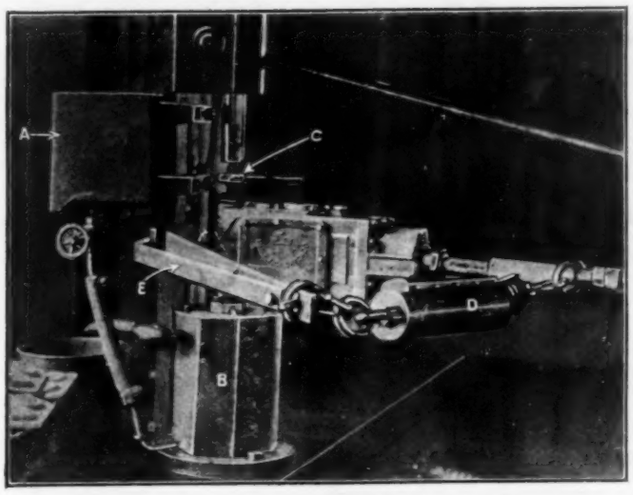


FIG. 41—TORQUE TESTING DEVICE

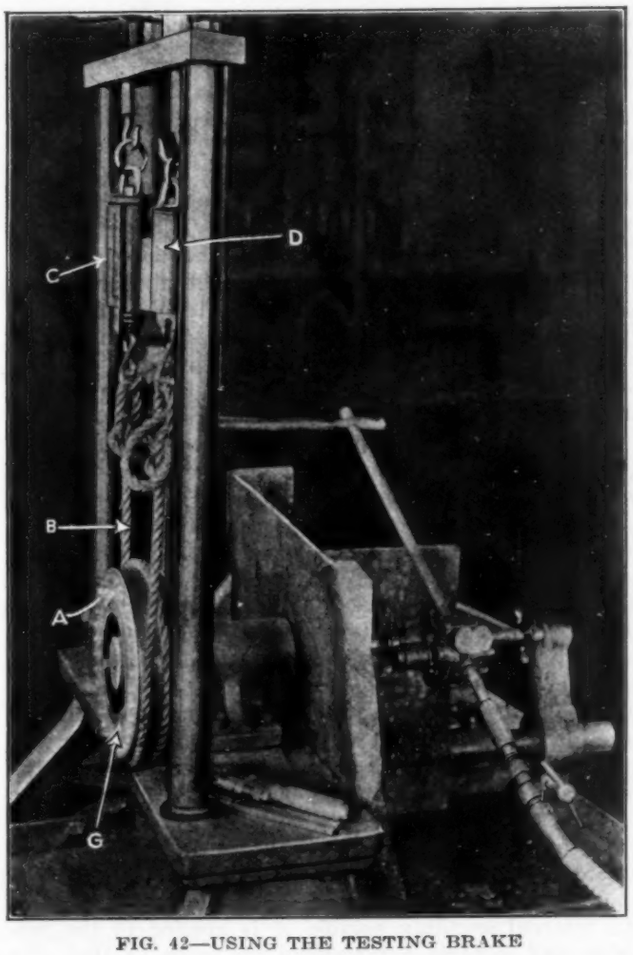


FIG. 42—USING THE TESTING BRAKE

difference in loading between the two sides can be determined by the operator. Greater or less tension can be applied to the rope by means of hand nuts on the upper end of the hook bolts from which the spring balances are suspended. The friction drum is made of brass and the outer side plate is open, as shown, so that water can be poured into the drum for cooling purposes. When the drum is standing still, the water is below the level of the bottom of this opening, but when the drum is in motion, the centrifugal force carries the water around the inside of the rim, cooling the drum and carrying off the heat.

The Encouragement of Amateur Writers

BY S. KELLY

The encouraging words to embyro journalists among the machinists' craft, offered by F. P. Terry of Belfast, Ireland, on page 519, Vol. 56, of *American Machinist*, should be productive of good results.

Most of us will recognize without difficulty, the three types mentioned in Mr. Terry's letter. The "swelled head" type, the "grab-all" type, and, thirdly, the able and practical, though very modest individual, are all familiar figures to those who know the present machine shop world.

From those in the first two classes but little of real value in the shape of contributions to mechanical knowledge may ever be expected. Conceit and superficiality are the chief characteristics of the "swelled-head" type of individual. He never asks for advice nor will he take any. Seldom will he copy or follow an approved method of doing any job and, as a result, invariably leaves behind him a train of spoiled work or "jimmed" machine tools.

Selfishness is the outstanding characteristic of the "grab-all" type. He is every ready to copy from his fellow workman and even to "steal his thunder." Although he, himself, is the shop's chronic borrower, he never has been known to lend assistance of any kind to those about him. He withholds information from the struggling apprentice; he takes unkindly to improved methods or contrivances for the betterment of working conditions, and views any device installed to secure greater production as a scheme designed solely to enrich his employer.

I agree with Mr. Terry that the modest, unassuming, practical man should have encouragement and sympathy in order to bring out successfully his latent ability. He is the man who does things, who uses his brains, who is resourceful and who can be depended upon at all times to solve problems for his superiors. Cheerful readiness, whether to do a job himself or to give others the benefit of his knowledge when asked, is the chief attribute of his character.

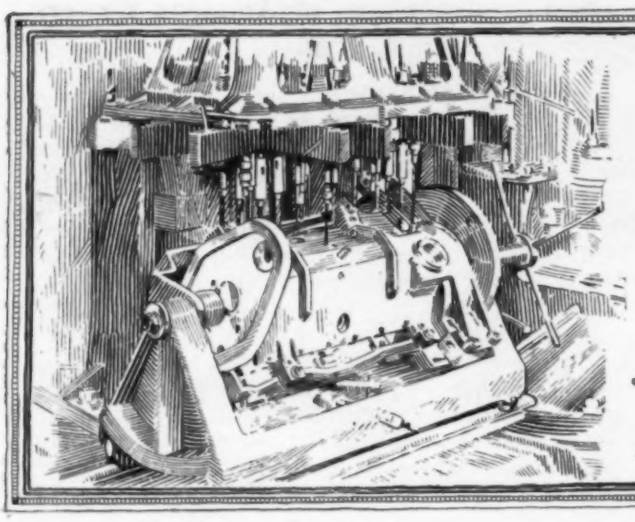
The value of men of this type among the shop's personnel is inestimable, and once he can be encouraged and persuaded to come out into the open with his ideas, his illustrations, and instructions, in his own language, for doing certain jobs, I am sure real benefit will accrue to readers of *American Machinist*.

Mr. Terry, in my opinion, should have gone one step farther in his letter of encouragement to writers by inviting criticisms from others to all published articles. This, it seems to me, would stimulate interest. Surely, Mr. Terry, Belfast man that he is, would have no objection to a more or less spirited controversy.

Increasing Interest by Instruction

BY ROBERT GRIMSHAW

That no worker is going to take more interest in his job than does his employer or his foreman, is a truth which may be accepted without argument. If the former or the latter does not care enough about the manner in which the work is done to give intelligent and inspiring instructions to enable it to be done, it is idle to expect the worker to lie awake nights, thinking up the best way to perform the task. Responsibility begins at the top of the ladder.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Fixtures for Grinding Operations—Principles Involved and Points of Design—Methods of Holding for Outside Cylindrical Grinding—Use of Arbors and Steadyrests

THE process of grinding is now used as a production operation to a considerable extent, whereas a few years ago it was considered more adaptable for accurate finishing operations after work had been hardened. For the removal of metal it was considered too slow a process to be of great value; but modern practice and the development of abrasives, together with the use of specialized machinery, shows a tendency toward the use of grinding as a production process. For the removal of considerable metal, grinding is not generally used, yet it is often found profitable for surfacing rough castings or forgings when a suitable finish allowance has been made. The tool designer must become familiar with the process of grinding and the machines used in order to thoroughly understand its applications to production work.

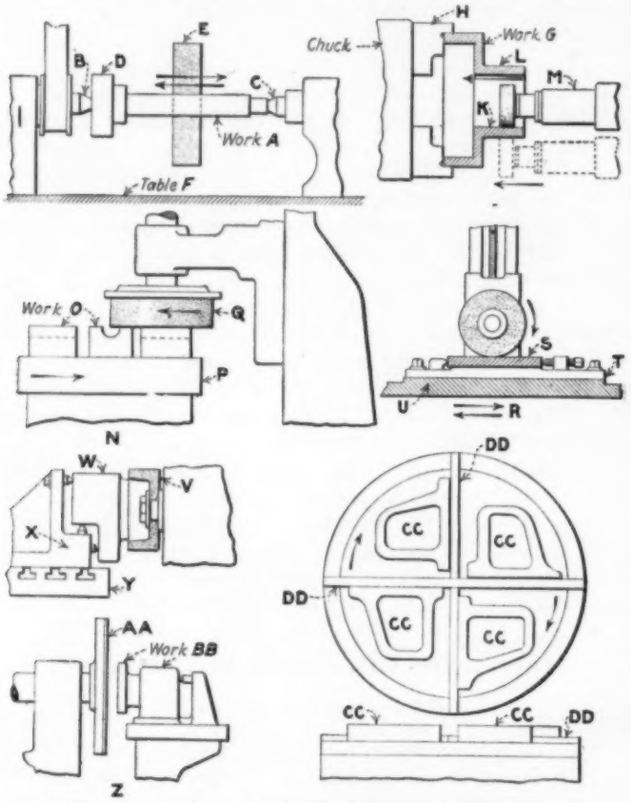


FIG. 411—EXAMPLES OF GRINDING OPERATIONS

A few examples which illustrate the application of the grinding wheel to the work in different kinds of grinding are shown in Fig. 411. The diagrams are fundamental and are intended only to illustrate the principles involved in the grinding process. In the example *A* the work is cylindrical; it is held between the centers *B* and *C* and a suitable driver provided at *D*. The wheel *E* is applied to the work as indicated and the table *F* is reciprocated backward and forward while the work is being revolved.

The wheel is fed in to the work a little at a time until the desired diameter is reached. It is customary to use comparatively heavy roughing cuts until the diameter has been reduced to a size slightly greater than that required, after which feeds are used in order to produce the required finish. The type of wheel and the quality of the abrasive are determined by the nature of the work, and it is not our purpose to go into detail in this regard. The tool engineer who is of an inquiring turn of mind can readily obtain the necessary data on grinding wheels by referring to manufacturers' catalogs.

In the example shown at *G* the work is held by the outside in chuck jaws *H*. The work to be done is grinding the inside surface *K* and the outside of the hub *L*. An internal grinding spindle *M* is applied to the machine, and suitable adjustments are made so that this spindle can take the positions shown by both the solid and dotted lines. The machine used may be a plain or an internal grinding machine.

A method used for surfacing either rough or finished work is shown at *N*. In this application the work *O* is held on a magnetic chuck *P*, which is so arranged that it revolves under the wheel *Q*. This wheel is usually of the cup variety, and it comes in contact with the work as the latter revolves. Fixtures can also be used on this type of machine if the nature of the work requires it.

Another method of grinding surfaces is shown at *R*.

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Here the work *S* is held in a fixture *T* or on a magnetic table, as may be found desirable. The table *U* reciprocates in the direction indicated by the arrows while the work passes under the wheel. The feed, which can be operated by hand or power, causes the table to move transversely under the wheel a little at a time. This type of grinding machine is more generally used for toolroom work than for manufacturing.

Still another type of machine uses a cup wheel *V*

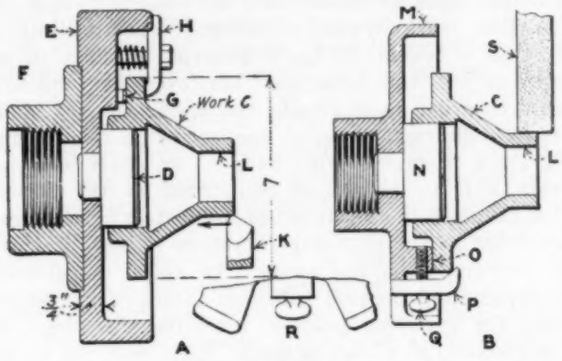


FIG. 412—TURNING AND GRINDING FIXTURES FOR A FLANGE

mounted on a horizontal spindle, and the work *W* is held in a fixture *X* which is mounted on the reciprocating table Y.

Any mention of grinding processes would not be complete without an example of disk grinding, which is shown in the illustration at *Z*. Machines for this kind of grinding are made with a single spindle, which carries a faceplate *AA* on which an abrasive disk is mounted. The work *BB* is held against this surface while the disk revolves, thus removing the stock and leaving a smooth finish. Another type of disk grinder uses two spindles which are opposed to each other, and the work which is to be surfaced is passed between them so that the grinding effect takes place on both sides of the work at the same time.

Another method of disk grinding is by means of a large abrasive plate lying in a horizontal plane and revolving swiftly. Castings such as those shown at *CC* are laid on the disk, and their own weight holding them in contact with the abrasive surface is sufficient to cause removal of the stock with considerable rapidity. Suitable crossbars *DD* can be placed across the disk, and against these bars the work is thrust in the direction of rotation, as indicated by the arrows.

Turning and Grinding

Fixtures which are used for turning and grinding are quite similar in their general features of construction; but the latter type are usually considerably lighter and the work does not need to be clamped as securely, because the removal of stock by the process of grinding is slower and does not tend to throw the work out of its position. In order to illustrate this point clearly two examples are shown in Fig. 412, in which a turret lathe fixture *A* is compared with a grinding fixture *B* for the same piece of work. In the example *A* the work *C* is located on a plug *D*, which is set in the fixture *E* bolted to an adapter *F*, the latter being screwed to the spindle. The work rests on studs at *G* and is clamped down by straps *H*. The construction of this fixture is fairly heavy because tools are used for removing stock, as shown at *K*, and the hole *L* is also bored in the same operation.

In the example shown at *B* the fixture *M* is very much lighter and is screwed directly to the spindle of the machine. A locating plug *N* centralizes the work, which rests against three points *O* and is clamped in place by light clamps *P* operated by thumbscrews *Q*. Protection is afforded the operator by placing the thumbscrews in the position shown by a detailed view at *R*. The wheel *S* is used on the outside of the work and an internal grinding attachment is applied for boring the hole *L*. The general construction of this fixture is much lighter than that used for the turret lathe, and the clamping is done by finger pressure. This illustrates the difference between the types of fixtures used for turning and grinding, but it should always be remembered that any fixture used on a grinding machine must be heavy enough so that it will support the work properly and not be subject to vibration.

In the grinding of shafts or other cylindrical pieces which are located on centers, there is very little for the tool engineer to concern himself about. There are occasional cases when a little ingenuity may be required to assist the grinding machine operator in setting up the work in order to obtain maximum production.

In the example *A* shown in Fig. 413 the work is a shaft 5 in. long x 1½ in. in diameter. If it were possible to grind this piece by employing the methods used in turning, one end would be driven positively and the other held on a center point. If the standard type of

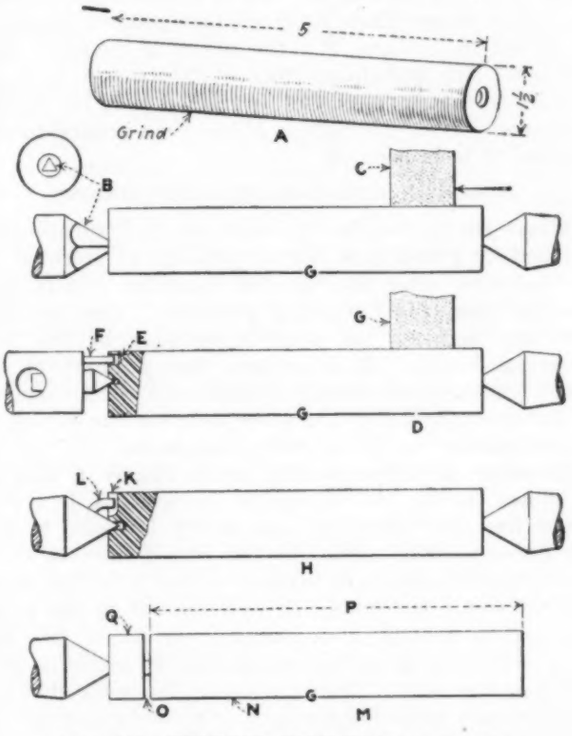


FIG. 413—HOLDING CYLINDRICAL WORK

"dog" is used, the work can be ground only up to a point close to the dog. In order to complete the shaft, the work would need to be reversed and the dog placed on the other end, after which the second grinding operation would have to be done very carefully in order that there would not be a shoulder where the second cut overlaps the first.

One method of avoiding this trouble is to use a special triangular center point like that shown at *B*. This center can be forced into the end of the work with sufficient pressure so that it will transmit torque enough to drive the shaft against the friction of the grinding wheel *C*. Another method which can be used for a similar piece of work is shown at *D*. Here the shaft is centered in the usual manner and a hole is provided at *E* in which the pin *F* enters. This pin exerts sufficient pressure to drive the work against the thrust of the grinding wheel *G*. Another method which will give good results is shown at *H*. The work is slotted at *K*, so that the pin *L* will enter the slot and act as a driver. Still another method which is quite frequently used for small pins is shown at *M*. Here the work *N* is made somewhat longer than required and grooved deeply at *O*, so that the distance *P* is the length of the piece when finished. The additional stock at *Q* provides sufficient surface so that a "dog" can be applied to it for driving purposes. After the portion *N* has been ground to size, the end *Q* is broken off.

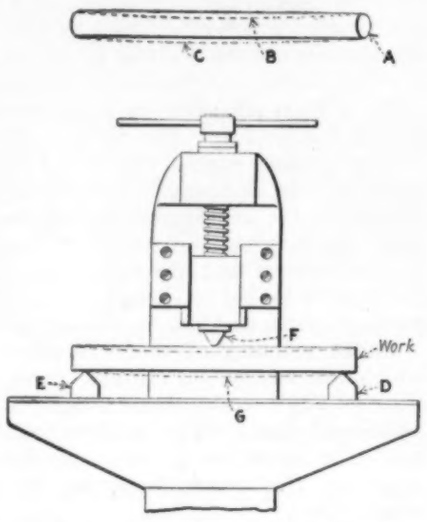


FIG. 414—STRAIGHTENING WORK BEFORE GRINDING

Straightening Work Before Grinding

When shafts are to be hardened and subsequently finished by grinding, a certain amount of stock is left on the work after the turning operation. It is quite possible that this "grinding allowance" does not take into consideration the possible warping of the work when hardening. It is seldom that a shaft of any great length can be hardened without a certain amount of distortion, and it is therefore necessary to straighten it preliminary to the grinding operation.

In order to illustrate this point clearly a diagram is shown in Fig. 414 in which the work *A* is a shaft which has been hardened, and which is found to have taken the position shown by the dotted lines at *B* and *C*. If an attempt were made to grind it in this condition, it would be impossible to reduce it to the proper size unless a very great amount of finish has been allowed for the grinding operation. In order to avoid the need for such a large allowance, the work should be straightened after hardening and before grinding. The usual method for a shaft is to place it on supports *D* and *E* and apply pressure to a block *F* by means of a suitably placed screw. The pressure can be applied by means of a handwheel or a lever, according to the requirements of the work. It will always be found necessary to depress the work considerably beyond its true center, as shown by the dotted lines at *G*, in order that it may spring back and return to a true position.

This example shows the importance of allowances for grinding. The sizes are usually determined by the engineering department, and the shaft should be marked with limits for both turning and grinding. It is essential that the tool engineer should be very careful to make all jigs and fixtures to the sizes which are produced by turning and not to the finish grinding sizes. If an occasion should arise where the grinding allowance does not appear to be sufficient, the matter should immediately be taken up with the engineering department and proper tolerances set.

Various types of steadyrests are used for supporting cylindrical work while grinding. The designs are somewhat different in their general features of construction, but the principles employed are much the same. In order to illustrate the application of steadyrests to cylindrical work, we have shown a few examples in graphic form in Fig. 415. The shaft shown in section *A* is to be ground cylindrical by the wheel *B*, which revolves in the direction indicated by the arrow. The thrust of the grinding therefore is both downward and outward from the wheel. In order to counteract this thrust and provide sufficient stability to the shaft during the grinding process, a simple steadyrest such as that shown at *C* can be used. This rest can be made of wood, if desired, and mounted so that it can be adjusted to give the necessary support.

In the example *D* the wheel *E* acts in the same manner as that previously mentioned, but two supports *F* and *G* are provided for the work. The lower support *G* obtains a contact with the work slightly ahead of the center, so that the action of the wheel has a tendency to hold the work firmly against both members *F* and *G*. These members are adjusted separately to suit the shaft diameter.

In the example *H* another type of rest *K* is used.

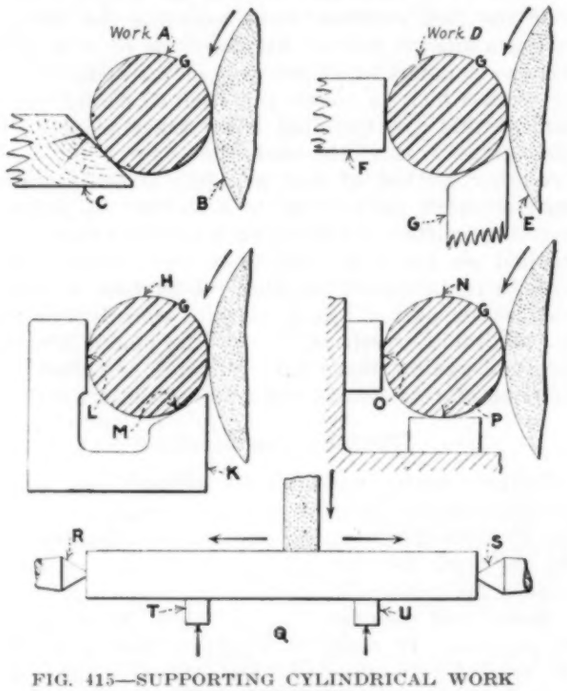


FIG. 415—SUPPORTING CYLINDRICAL WORK FOR GRINDING

The steadyrest is made in one piece and proportioned suitably to give the necessary stability. It has a contact with the work at *L* and *M* very similar to that previously mentioned. Another type, shown at *N* has two adjustable members *O* and *P* which are mounted

so that they can be very easily brought into contact with different diameters of work.

In grinding long work several steadyrests may be necessary, and in order to secure accuracy the position of the steadyrests should be as shown in the example *Q*. The work is supported on centers at *R* and *S*, and two steadyrests *T* and *U* are placed in such a position that the support is equally distributed along the length of the shaft, the distances between the steadyrests and centers being approximately the same. This is an important matter when setting up a shaft for grinding, and if considerable care is used when placing the steadyrests much better results will be obtained.

Points of Design

Many of the principles which have been previously described can be applied equally well to the design of fixtures for grinding, and many cautions which have been given in regard to other types of fixtures should be reviewed and applied here. A few additional points should be given because the action of a grinding wheel is somewhat different from that of a cutting tool.

(1) Stability of fixture and proper balance are important factors in design. Vibration causes chatter which makes it impossible to produce good work in either turning or grinding. Therefore, the greatest care must be used to make sure that fixtures are sufficiently rigid and well balanced, so that they will not set up vibrations in the work or the machine. In grinding, the fixture revolves slowly while the wheel turns rapidly, and it may seem to the designer that with such comparatively slow movement the balance of the fixture is not important. It will be found, however, that any holding device which is considerably heavier on one side than on the other will be likely to produce inaccurate work. Therefore, when such a condition

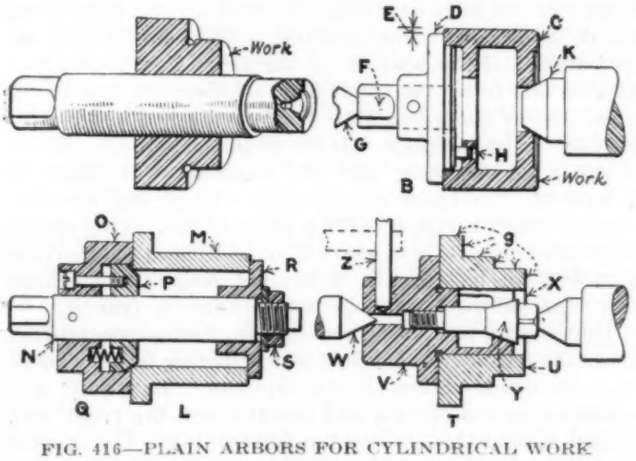


FIG. 416—PLAIN ARBORS FOR CYLINDRICAL WORK

is found, the defect should be counteracted by the use of a counterpoise.

(2) The location of the work is important, as it is in all fixtures, and due to the fact that abrasives are being used continually there is a great deal of such matter that finds its way into the fixture. Consequently, locating surfaces and plugs are likely to lose their size quite rapidly on account of the abrasive action, so that they should be made replaceable if good results are to be obtained. If indexing pins are used great care must be taken to protect them, so that they are not subject to the action of the grinding dust.

(3) The method of holding the work in grinding fixtures is the same in principle as that used for fixtures for turret lathes and other machines of a similar kind. The amount of stock removed by the grinding wheel is much less than when turning or boring, and there is consequently less pulling action which tends to displace the work. Therefore, it is often possible to use spring clamps or even springs to hold the piece

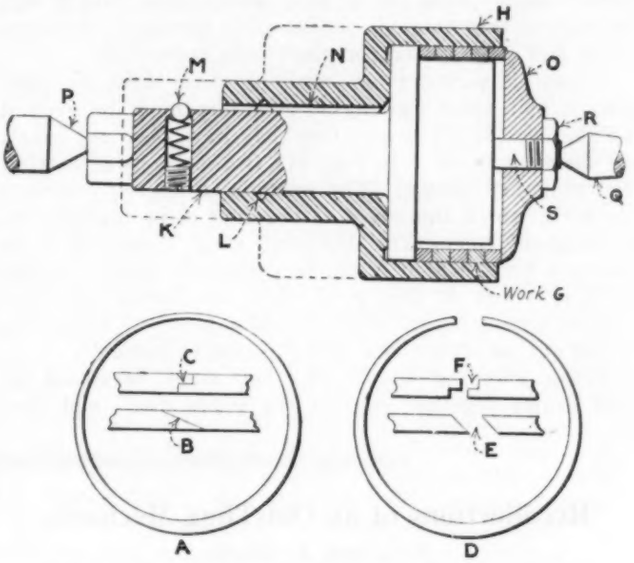


FIG. 417—ARBOR FOR GRINDING ECCENTRIC PISTON RINGS

in position. Many times magnetic chucks are used in certain kinds of grinding, the holding power of the magnets being sufficient to withstand the pressure of the grinding wheel.

(4) Work may be ground either wet or dry, depending on conditions. In the case of fixtures used for wet grinding, provision should be made so that the water can run out of the fixture freely. This is a very small matter and yet it should receive consideration when designing fixtures. There may be occasional cases where a special application will be found necessary in order to direct the stream of water into the proper position.

A few examples of simple arbors used for holding work while grinding are shown in Fig. 416. The diagram at *A* is a plain taper arbor of the standard type, such as commonly used for turning cylindrical work. The example *B* shows a piece of work *C* mounted on a shouldered collar *D*, the outside diameter of which is slightly smaller than the finished outside diameter of the work, as indicated at *E*. The collar is pinned to a short arbor *F* which locates on the center *G*. The work is driven by means of a pin *H* entering the hole as shown. The outer end of the work is supported on the center *K*.

Another method of locating and holding is shown at *L*, in which example the work *M* has been previously finished. The arbor *N* has a collar *O* pinned to it, and a taper locating plug *P* is mounted by means of springs *Q* so that it forces itself into the end of the work, thus giving the central location. The collar *R* at the other end of the piece is clamped in place by means of nuts and washers at *S*, which action draws the work back against the face of the collar *O*. The centers in each end of the arbor hold it in position for the grinding.

A simple type of expanding arbor is shown at *T*. The

work *U* requires grinding operations on the various surfaces and shoulders, as indicated by the arrows. The arbor *V* has a center *W* in one end, while the other is split at *X* in three places and expanded by means of the screw *Y*. A similar arbor to this has been described in the articles on turret lathe work. The method of driving is by means of a pin *Z* which lies against a projecting stud in the faceplate. All of the arbors shown here are of very simple type, and it will be evident that there is considerable similarity between them and arbors used for machining operations.

Eccentric piston rings such as those used in automobile and other gas-engine cylinders must be ground on the outside diameter after they have been cut apart. In the example at *A* in Fig. 417 two methods of cutting the ring are shown. The example *B* is the ordinary form, in which the edges of the ring come together on a diagonal line. The lap-joint ring shown at *C* is another form, which is not so commonly used. In machining rings of this kind, they are bored and then turned eccentrically, after which a piece of each ring is cut out, as shown at *E* and *F* in the example *D*.

When grinding the rings, they must be closed up and drawn together so that the edges meet, and they must be held in this position during the process of grinding. A method of holding frequently employed for this kind of work is shown in the same illustration. From four to six rings *G* are sprung together and placed in the shell *H*, which is mounted on an arbor *K* so that it is sliding fit. The collar *O* is brought up against the edge of the outer ring and clamped in place by the nut *R*. The stud *S* is centrally located in the body of the arbor and contains a countersunk portion in which the center *Q* locates. The other end of the arbor rests on the center *P*.

After the rings have been placed in position and the collar tightened, the operator pulls the sleeve *H* back as indicated by the dotted outline. This leaves the rings clear, so that the grinding wheel can be used to finish the outside diameter. The arbor is furnished with a ball *M*, which acts as a "detent" in the groove *L* when the sleeve is pulled back from the rings. A point of importance in connection with the design is the groove *N*, which is used solely for the purpose of relieving the air pressure when moving the sleeve backward and forward on the arbor. Unless some provision for this relief is made, great difficulty will be experienced on account of the close fit.

Recollections of an Old-Time Mechanic

By John J. Grant

After leaving Brown & Sharpe's shop I went into a woolen mill and helped the all-around man who did the repairs. I had the starch taken out of me when I encountered a job that it seemed impossible to do with the tools we had. It was done, however, and I had sense enough to see that if I was ever to become the all-round man I hoped to be, I must be able to do these jobs and others that would put me in a tight place.

I went to Northampton, Mass., and hired to a man who ran a foundry, machine shop, sash and blind shop —Old Bill Clapp. Nothing got away from him, he would take anything from cleaning a watch to building an 18 x 42-in. steam engine. I worked there for three years and laid the foundation for all the success in mechanics that has come to me.

The shop had a fair equipment of tools, as shops were supplied in those days. As far as I can remember there were three small engine lathes of 14- to 16-in. swing, wooden beds with iron V-s and chain feeds; a 16-in. lathe, a little more modern, which I remember had a curious arrangement of the speed-reducing gears, all inside of the cone pulley, and one 16-in. lathe, made by the Hadley Falls Machine Co., Holyoke, Mass. This was our star lathe and used for the best work. We had several other lathes all of the same general design, but only one with the feed in the apron.

A 24 in. x 20 ft. bed lathe was used for a shafting lathe and I have turned miles of shafting 2 to 3 in. in diameter on it, at the rate of about 30 ft. per day. We used all iron shafting in those days and when Old Bill had taken a job extremely low, he bought correspondingly bad iron for the job. This iron was full of sand streaks, so we were obliged to stop the lathe every foot or two and chip out the sand streaks.

We turned all shafting to a ring gage and it required constant watching to keep the size close enough to fill the ring, and free enough to pass through. The diameter of the ring gage was enough larger than the finished size of the shaft to allow for filing. We had standard rings bored out to inside calipers set to a scale with the corners worn off but it was a standard even though it did not match the other fellow's who made shafting. Old Bill used to chuckle when we told him about it, and say, "Well, that is all right; the people who buy this shafting will have to come to me for pulleys."

We had an 8-ft. lathe built on a stone foundation having the cast-iron ways bedded in sulphur. This lathe was not very accurate, but we did some good work on it, as it was strongly built. The spindle was of cast iron, and the bearing on the front box, which was also of cast iron, was about 8 in. in diameter and 10 in. long. After many years use the bearing had a beautiful surface. The faceplate was keyed to the spindle. While doing a job I found that the faceplate was loose, so I took off the front spindle cap, backed out the key and shimmed under it with a piece of tin. This threw it out of true nearly a quarter of an inch at the periphery, but we had to use it in that shape for at least one year before I could get permission to true it.

Our drill press was home-made, being constructed from the headstock of an old wood-turning lathe. There was no quick return to the spindle. The quill was threaded on the outside and ran through the front box. It had a handwheel at the top for feeding. The spindle was driven by a pair of cast bevel gears at the top. One of these gears was mounted on a horizontal shaft which went through a hole bored through the post to which the drill press was bolted. There was a cone pulley on this horizontal shaft, and another shaft on the bottom of the post with a cone and tight and loose pulleys.

The table was a large angle casting bolted to the post and arranged so that it could be moved up and down. The spindle had a straight hole and drills or collets were fastened in with a setscrew. We had no twist drills, reamers, taps, dies, or milling cutters except home-made ones, and some of them were fearfully and wonderfully made.

An Engineer's View of Standardization of Machine Tool Elements

By Harry E. Harris

During the writer's experience as an engineer in charge of equipment, design, purchase and installation in both large and small corporations, he has repeatedly standardized machine tool elements and equipment as well as small tools in the companies that he was connected with. Take for instance the matter of draw-in collets for lathes, milling machines, bench lathes and small grinders; he has adopted a certain collet as standard and put in new spindles or re-made the existing spindles so that this collet adopted as standard could be used interchangeably throughout. This eliminated considerable confusion in the toolroom and the necessity of having a number of sets of different styles of collets, lost time finding the proper collets and also putting collets in the wrong spindles, stripping threads and producing inaccurate work.

Another point which was standardized was the nose thread on lathe, milling machine and index head spindles, so that if machines were within a certain range, the same chucks, drivers, boring heads and faceplates could be used interchangeably. This is often of advantage when work has been strapped up on a lathe faceplate, or put into a chuck and then transferred to a milling machine for further operations. It also eliminates the duplicity and complicity of the chucks and chuck parts, faceplates, etc., in stock as the nose threads on the spindles and the internal threads in the backing plates were made to gage. They always fitted satisfactorily. In some cases, upright drills carrying lathe chucks and boring heads, were fitted with nose threads on their spindles to correspond to the above which proved to be of considerable advantage in many cases.

Eliminate Unnecessary Tapers

Another point which should be considered is the matter of centers and tapers. It is a matter of great expense and confusion in reamers and chuck shanks. It is my belief that a standard taper should be adopted and the large number of useless tapers be discarded as was undertaken and put through in regard to screw thread sizes some years ago.

Other details which might well be standardized even further than they are today, are countershaft speeds, hangers, boxes, shaft sizes, and pulleys. The speed at which cutting tools can cut or should cut is well known. A certain size lathe should have a certain range of speeds and the belt should transmit a certain horsepower at each speed and in case of cone driven lathes, the diameters of the steps of the cone pulleys, the face width for the belt and the number of steps could well be standardized for each size, as also could be the length and diameter of the bearings.

While we are on the subject of lathes, the toolposts could be standardized so that all lathes of similar size would take the same size tool. I have made it a practice when buying a new lathe, to change the toolposts to conform to a tool which was standard for that particular size of lathe, and have found quite a variation in toolposts. Where this is not done, some toolposts are found too small to fit the tool and the tool has to be ground down to fit.

Another thing which could well be standardized, and there has been some work along this line, would be T-slots of the different machine tools, so that a set of standard bolts and clamps could be used for milling machine, faceplate, shaper table and small planer work; and a set of standard clamps could be laid out and could be carried in the stock room instead of having them kick around each machine.

First Standardizers Will Reap Harvest

We are coming to a period of keen competition and the firms who are first to supply standard goods will assuredly reap the benefit, as users are well aware of the great waste that goes on in their factories due to the duplication and complication of machine tool elements and accessories, the confusion caused by not being able to find the proper part to fit and the large inventory of this kind of material each concern has to carry for each individual type of machine tool.

I, as a buyer, appreciating the large saving that this would make in my business, would consider the purchase of an inferior machine tool, if I knew that its elements were to an accepted universal standard, rather than a similar machine tool of well-known excellence of high reputation but which had everything peculiar.

I am a great enthusiast on standardization and have seen the benefits derived from it. Some years ago in one shop having 7,000 emplyees and of international renown, I carried on the work of standardizing their small tool parts for jigs, such parts as latches, clamps, bushings, feet, hinge leafs, etc. The general dimensions being standardized, saved much of the designer's and mechanics' time and allowed us to manufacture the elements and carry them in stock ready for withdrawal by the toolmaker, who simply had to suit them to the job in hand. Likewise in punches and dies, I standardized the clamps and clamping bolts and die beds, die blanks, strippers, feed fingers, punch holders, punch blanks, liner pins and liner pin bushings. We carried all these in stock in several different sizes, making it a simple matter to make a die. All the diemaker required was a sketch showing the layout of the die itself and giving the stock number of the various blanks to be withdrawn from stock.

The same standardization was carried throughout on gages, screw machine tools, etc., it being only necessary for the special job, to withdraw the blank from the stock room by its stock number and finish it to suit the special job in hand. This company is producing better tools than any other company that I know of and doing it for much less cost; this cost being approximately one-half of what they can have the same tools built by tool building concerns for them. This gives you some idea of the value of standardization.

Standardization is also of immense value in the question of replacements and reducing the cost to the manufacturer of the machine tool and its parts. A large saving would be made also to the manufacturer of machine tools in the matter of initial costs and upkeep of his special gages and tools in his designing department. He would be able to buy standard gages and tools made by gage and toolmaking concerns on a commercial quantity production basis much cheaper than he could build gages and tools himself and would require fewer of them and in the engineering department, a high priced engineer would not be compelled to give any consideration to such elements, except to select the right thing from a table of standards and have the detail draftsman specify it on the drawings.

Extracts from a letter to the Standards Secretary, A.S.M.E. Published by permission.

Methods of Machine Tool Design

Third Part of Chapter on Gear Drives—Speed Variation by Means of Sliding Gears—Arrangements of Gears—Rounding of Teeth

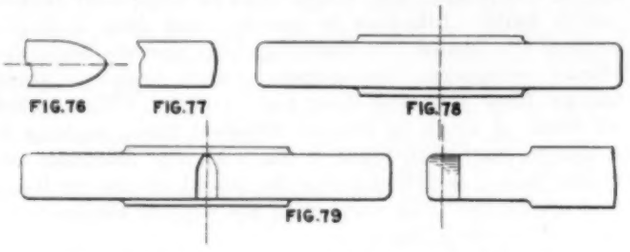
BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

IN THE foregoing paragraphs general features were discussed; considerations which lead up to the selection of a certain design, but without considering details. We have found how much power must be transmitted, how many shifts we should make for a given number and range of speeds, etc. We must now see what means there are available to obtain the desired results.

The various desired speeds are obtained by speed variators, of which several may be used in one speed-changing device. We can make changes in one of these variators, or change over from one to another; or, what happens perhaps more often, do both, when we want a change of speeds.

Speed variators are of different types, the principle ones being: Sliding gears; cone gears and tumbler; pull pin gears; back gears; clutch arrangements; differentials; combinations of some of these devices.

Sliding gears should be made with rounded teeth on that side where they enter into mesh. Both meshing gears should have the teeth rounded. The amount of round depends on the pitch of the gears and on their circumferential speed. If the gear has several speeds, the highest should be considered. Up to 6 pitch and



FIGS. 76 TO 79—FORMS OF ROUNDED TEETH

with a speed not exceeding 600 ft. per minute, $\frac{1}{8}$ in. is enough for the round. Heavier pitches than 6 diametral and speeds below 600 ft., or 6 pitch or less and more than 600 ft., require $\frac{3}{16}$ in. Heavier pitches and speeds above 600 ft. require $\frac{1}{4}$ in. or more.

An excess of round does no harm, but it must be remembered that in figuring tooth pressure *the round must not be figured;* so that more round than is necessary adds to the face of gear, length of shaft, etc., without compensating features. The round should be made as in Fig. 76, and not as in Fig. 77. It is sometimes thought that the round appears as in Fig. 78. Such a round is only given to prevent the gear from being damaged in handling and a very small amount serves for this purpose. The round intended for the gear shift is shown in Fig. 79. This round is made along the face and flank of teeth. The existing machines for making the round produce one also at the top, though this is not required. Sliding gears should be close to a bearing when in mesh. Figs. 80 and 81 show the right and wrong way of arranging them. Many designs exist which ignore this requirement.

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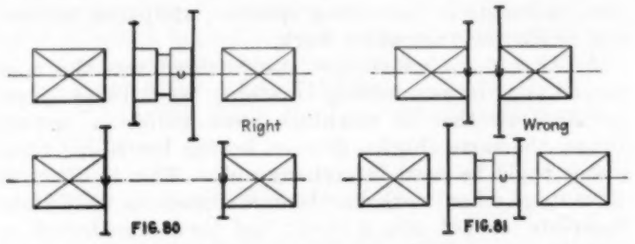
The pinion which transmits the power from a sliding gear shaft to another shaft should be placed as near as possible to the largest gear of the sliding gear system. The reason is that this gear produces the maximum torque on that shaft, and that therefore the deflection will be held to a minimum when that part of the shaft between the gear and the transmission pinion is as short as possible.

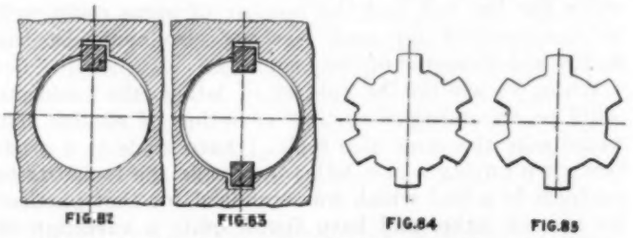


FIGS. 80 AND 81—RIGHT AND WRONG WAYS OF ARRANGING SLIDING GEARS

The shaft on which the gears slide should be provided with at least two keys. If possible, these should be made larger than standard to provide more bearing surface. The reason why more than one key should be provided (and this holds good for clutches and other similar sliding parts) is that there must always be some difference in size between the bore of the gear and the diameter of the shaft, and that this causes a wedging action. This is shown in exaggerated form in Fig. 82. When two keys are used, the action is as shown in Fig. 83. The best and most modern practice is to use splined shafts for sliding gears. The number of splines in such shafts varies from four to ten. Often the shafts are hardened and the splines ground. The rather modern processes of broaching the gear and hobbing the shaft have made this construction practicable.

CROSS-SECTIONS OF HOBBED SPLINES

When providing a splined shaft which is to be hobbed, the following should be remembered: It is not possible to hob a squared corner at the bottom of a spline. The section should therefore be made as in Fig. 84 or else as in Fig. 85, but in the latter case



FIGS. 82 AND 83—METHODS OF KEYING GEARS.
FIGS. 84 AND 85—CROSS-SECTIONS OF SPLINED SHAFTS

the gear should bear on the tops of the splines only. The first-mentioned construction is to be preferred because it provides more bearing surface for the gear.

The length of the sliding gears on the shaft should

be as much as conditions will permit and should never be less than the diameter at the point where the shifting fork engages the gear. This diameter should be measured at the farthest point of engagement (see Fig. 86).

Larger gears require greater length on the shafts, because there is a tendency to cant the gear when it butts against the mating gear before the teeth enter. This canting effect may make it difficult and even impossible to complete the shift.

If it is intended to shift the gears while running,

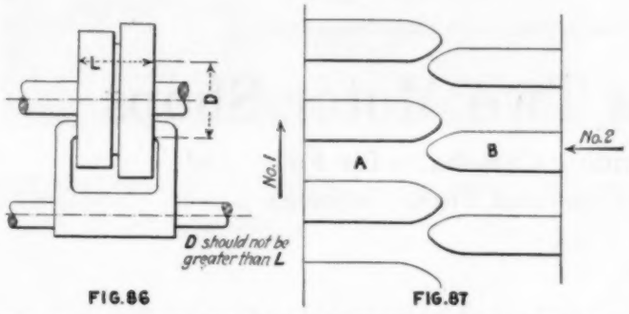
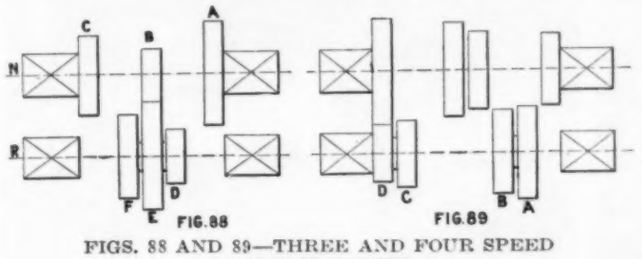


FIG. 86—DIAGRAM OF GEAR SHIFTING FORK. FIG. 87—DIAGRAM OF GEAR ACTION WHEN SHIFT IS TOO SLOW

care should be taken not to have much difference between the old and the new speeds. It should not be forgotten that large masses may have to be speeded up and that the load on the mechanism is proportional to the acceleration we must impart. This acceleration is necessarily very great, because the time available for the change from low to high speed is very short. This time is merely the amount of time required for the rounds of the gears to pass each other and, in addition, a few degrees of one revolution of the driven and driving shafts and possibly some other shafts besides, due to their torsional deflections.

It would seem, then, that one should shift the gears slowly, but this would cause another difficulty. Fig. 87 illustrates what happens when we try to shift slowly. While the stationary gear travels in the direction of arrow No. 1, the sliding gear moves in the direction of arrow No. 2. If the speed of *A* is high and that of *B* is low, the sliding gear will have penetrated but a very short distance between the teeth of *A* before the rounds of the two gears come in contact with one another. Gear *A* will then have a tendency to push *B* back.



FIGS. 88 AND 89—THREE AND FOUR SPEED ARRANGEMENTS

This action will be repeated again and again, causing the rattling or clashing of the gears when they are not properly shifted.

Unless the speed of *B* in the direction of arrow No. 2 is great enough to bring the straight portion of its teeth opposite the straight part of the teeth of *A*, such clashing will occur. This condition is aggravated by the high speed of *A*, low speed of *B* in the direction of shift, and heavy load. When the load to be picked up is light, it may be possible to force the sliding gear into place even with a slow shift.

The sliding gear system has been taken up first because it is the most satisfactory of all speed variators in which gears are the means of obtaining the various speeds. However, its application is limited for various reasons. In the first place, it loses some of its desirable features as soon as more than two speeds are to be obtained in one shift. Fig. 88 shows a sliding gear arrangement for three speeds. As will be seen, it is no longer possible to have all of the stationary gears close to a bearing. It is further necessary to pass through one of the speeds in order to obtain one of the other two. If, for instance, in Fig. 88 *R* is the driving and *N* the driven shaft, we will obtain the high speed in the position as shown; i.e., with *B* and *E* in mesh. In order to go from the medium to low speed we have to pass through high. We also find that the length between bearings becomes rather great. If we call the face of the gears *F* and the clearance between adjoining gears, when in neutral position, *C*, the length between bearings with a two-speed arrangement would be $4F + 3C$; while with a three-speed arrangement it would be $7F + 6C$. If it were possible to make the length of the shaft proportional to the number of speeds, it would be $\frac{3}{2} \times (4F + 3C) = 6F + 4\frac{1}{2}C$, so that we have lost $F + 1\frac{1}{2}C$. Another thing to be noticed about the three-speed arrangement is that gear *F* must have at least four teeth less than gear *E* in order to slide under gear *B* without touching.

A four-speed arrangement may be constructed as

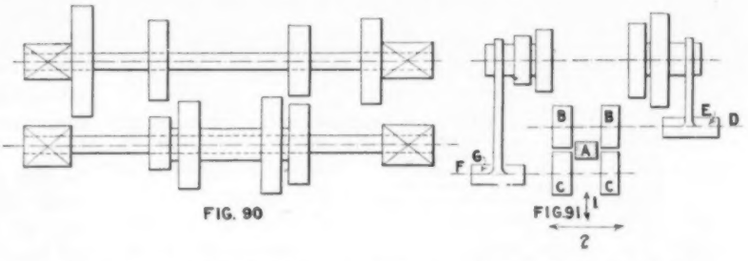


FIG. 90—ANOTHER FOUR SPEED ARRANGEMENT. FIG. 91—DIAGRAM OF SHIFTING COLLARS AND FORKS

in Fig. 89 or Fig. 90. The construction of Fig. 89 requires a rather complicated shifting arrangement. It is necessary to pick up gears *A* and *B* while *C* and *D* are being held in a locked position. When it is necessary to shift *C* and *D*, gears *A* and *B* must first be brought to the neutral position and there secured against sidewise movement, after which *C* and *D* may be picked up and shifted. The way in which this is ordinarily accomplished is shown in Fig. 91 in diagrammatic form. The lever *A*, shown here in section, can swing in the direction of arrows Nos. 1 and 2, and is thus able to engage either collars *B-B* or *C-C* and move them sideways, thus moving either rod *D* and fork *E* or rod *F* and fork *G*. To lock the inactive fork, spring plungers are sometimes used, or a positive lock may be pushed out of the way by the lever itself. This matter will be more fully treated in the chapter on interlocking devices. Many other shifting devices are possible operated by cams and other mechanisms.

It is, of course, possible to have more than two sets

of sliding gears on one shaft and operate them with two, three or more forks, all operated by one lever, but such devices become complicated and are not much used. Besides, the gears would become too large if the range of speeds is considerable. With two even belt cones we found that, if the largest step had a diameter D and the small step a diameter d, the range of speeds was $\frac{D^3}{d^3}$. The same would be the case with sliding gears if we were willing to have a large gear drive a small one. This, however, is not desirable. We aim to slow down as we go further, so that the range of speeds is much less than the value expressed by $\frac{D^3}{d^3}$.

The four-speed arrangement shown in Fig. 90 requires a length of shaft of 12F + 11C and is therefore not to be recommended except, perhaps, for light loads. It has various other disadvantages besides the great length of shaft, such, for instance, as the fact that there is no regular increase or decrease of speeds when going from right to left.

Making Camshafts in Two Motor Shops

Methods Used in Turning and Grinding Camshafts for Four- and Six-Cylinder Motors—Operations and Their Sequence

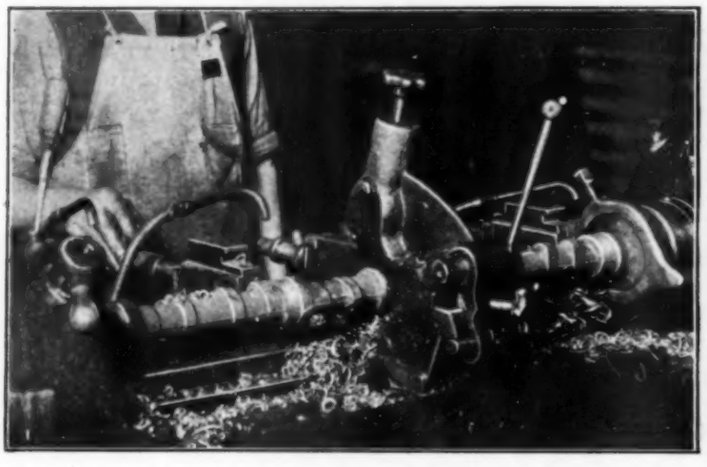
BY FRED H. COLVIN
Editor, *American Machinist*

THE method used in machining the Pierce-Arrow camshaft may be of interest and is given in considerable detail herewith. The list of the various operations and the allowance for grinding is as follows:

(1) Grind flash on ends for centering.
(2) Center both ends.
(3) Straighten.
(4) Rough-turn Nos. 1, 2 and 3 bearing diameters for steady-rests; allow 0.062 to 0.065 in. for finishing.
(5) Finish-turn large flange; allow 0.018 to 0.020 in.; face both sides of large flange and inside of small flange; allow 0.018 to 0.020 in. between large and small flanges and 0.014 to 0.016 in. on outside face of large flange.
(6) Finish-face cams Nos. 1 and 2; turn and face back of small flange at No. 1 bearing and front flange at No. 2 bearing.
(7) Finish-face cams Nos. 3 and 4; turn and face back of rear flange at No. 2 bearing and front flange at No. 3 bearing.
(8) Finish-face cams Nos. 5 and 6; turn and face back of rear flange at No. 3 bearing and face back of No. 4 bearing.
(9) Finish-face and neck flanges at No. 2 bearing; turn Nos. 1 and 2 bearing diameters; allow 0.020 to 0.025 in. and neck No. 1 bearing.
(10) Finish-face and neck both flanges of No. 3 bearing; turn Nos. 3 and 4 bearing diameters; allow 0.020 to 0.025 in. and face counterbored end.
(11) Rough-turn between cams.
(12) Face front end and re-center.
(13) Counterbore and re-center rear end.
(14) Rough-grind cams; allow 0.025 to 0.028 in. on diameter for final grind.
(15) Grind dip in cams; allow 0.025 to 0.028 in. for finish-grind.
(16) Drill, countersink, burr and tap flange.
(17) Straighten.
(18) Carbonize.
(19) Straighten.
(20) Harden and anneal flange.
(21) Sand blast.
(22) Polish centers and straighten.
(23) Grind all bearing diameters and grind joint face of large flange and inside faces of both collars for front bearing.
(24) Test bearings and straighten if necessary.
(25) Final-grind cams.
(26) Stone high points of cams and break sharp corners around edges of cams.
(27) Test for truth and straighten if necessary.

The rough-turning of the bearings is shown in Fig. 1, a Lo-Swing lathe being used for this purpose. The facing of the shoulders and cams is shown in Fig. 2 and the rough-turning between them in Fig. 3. The method of driving the camshaft can be seen in the various operations. In the first a bent tail dog is used on the large flange; in the second, a three-jawed chuck grips the flange after it has been turned; and in the third operation a special form of driving clamp can be seen. The camshaft is then carburized and hardened, after which the flange is annealed. The shaft is then straightened on centers as shown in Fig. 4, the dial indicator testing the concentricity of the various bearings. The indicator can be slid along the splined bar to any desired position. A straightening press can be seen just to the right of the operator. The finish grinding of the camshaft is shown in Fig. 5, and requires no special explanation.

The cam testing fixture used by the Peerless Motor Car Co., of Cleveland, Ohio, is shown in Fig. 6; it resembles in many ways the type of machine shown in a previous article, but has an indexing mechanism on



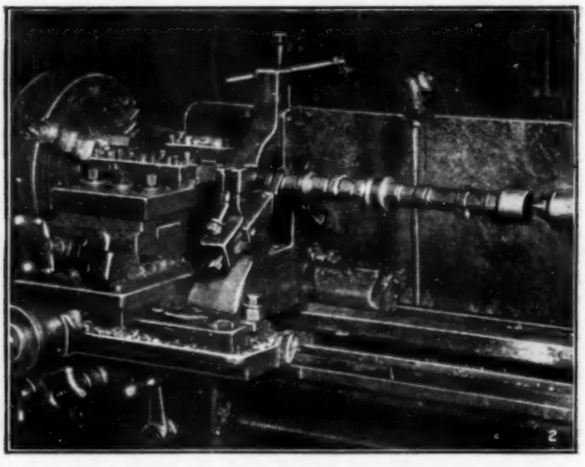
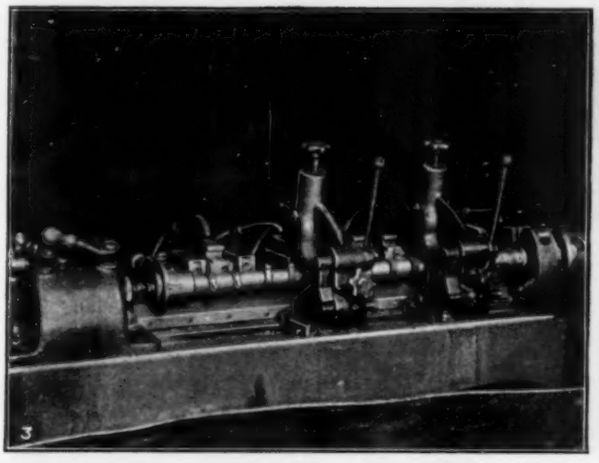
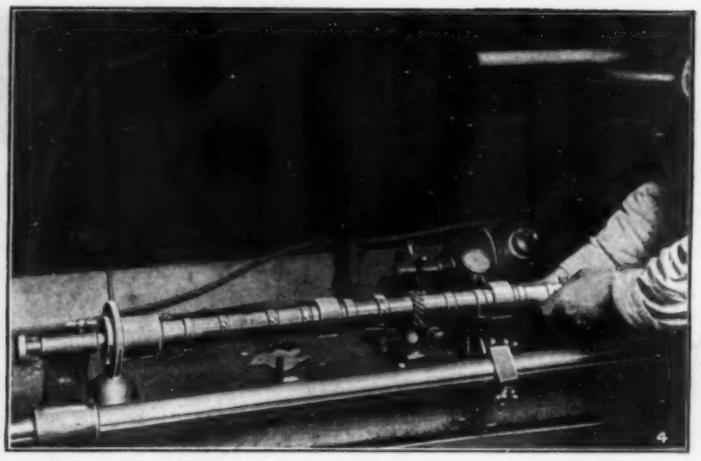
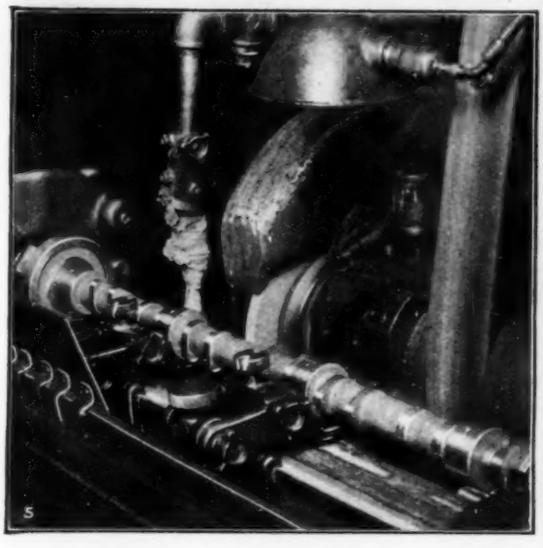


FIG. 1. FIRST OPERATION IN LO-SWING. FIG. 2. FACING THE SHOULDERS







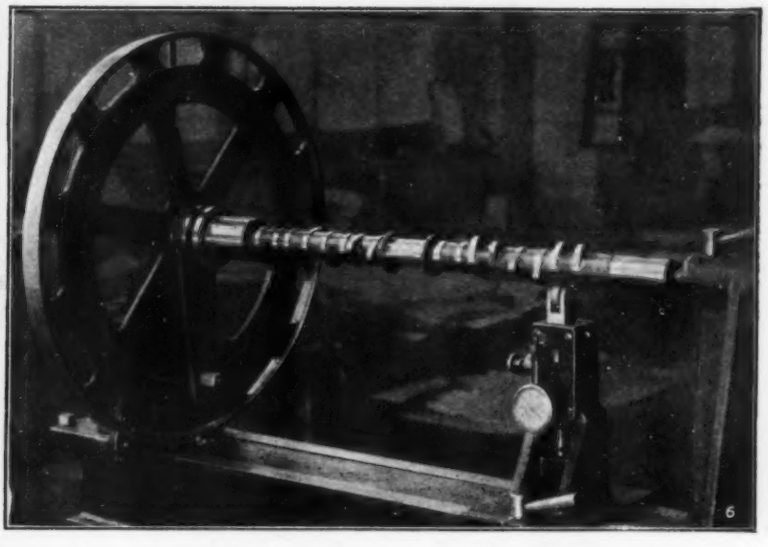
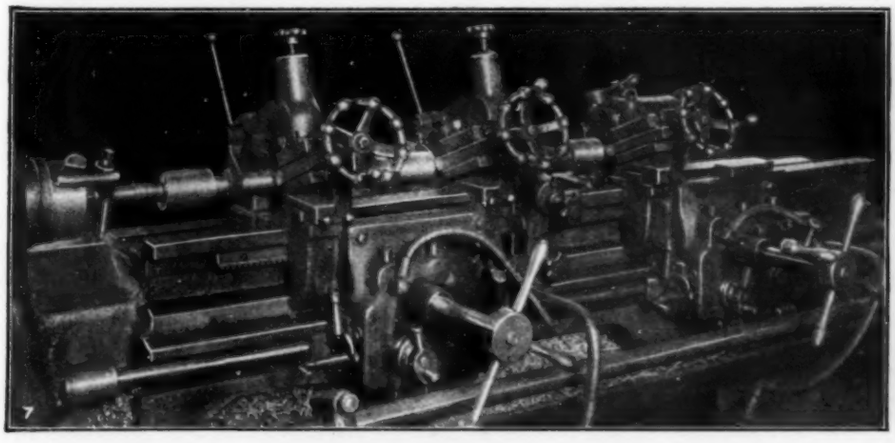


FIG. 3. FINISH TURNING CAMSHAFT. FIG. 4. STRAIGHTENING AFTER HARDENING
FIG. 5. FINISH-GRINDING THE CAMS. FIG. 6. PEERLESS TESTING FIXTURE

the large wheel in addition to an outside pointer, showing the angularity of the cams in degrees. This camshaft is for an eight-cylinder motor, while the Pierce-Arrow camshaft handles only the inlet valves for a six-cylinder motor. The Pierce-Arrow is a dual valve motor, having two inlet and two exhaust valves to each cylinder, hence the twelve cams on the shaft in Fig. 4.

The camshaft for the Mack motor, like the crankshaft, is made of carbon steel and then carburized so as to secure an extremely hard bearing surface. The ends of the forgings are ground, if necessary, and the camshaft is centered, after which a preliminary straightening takes place. Then the center bearing is rough-turned, the shaft turned between the cams and the other rough-turning operations completed. The shaft is then ready for another straightening, followed by three finish-turning operations, one being shown in Fig. 7, utilizing a Lo-swing lathe with three toolposts. The



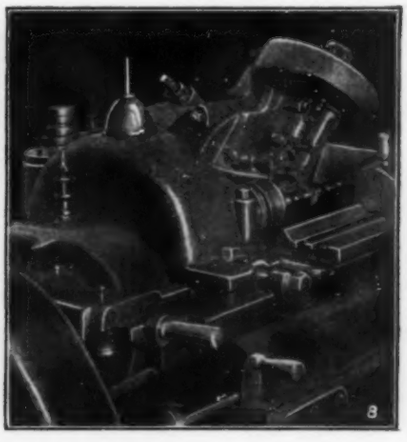


FIG. 7. TURNING THE CAMSHAFT. FIG. 8. HOBBING THE SPIRAL GEAR

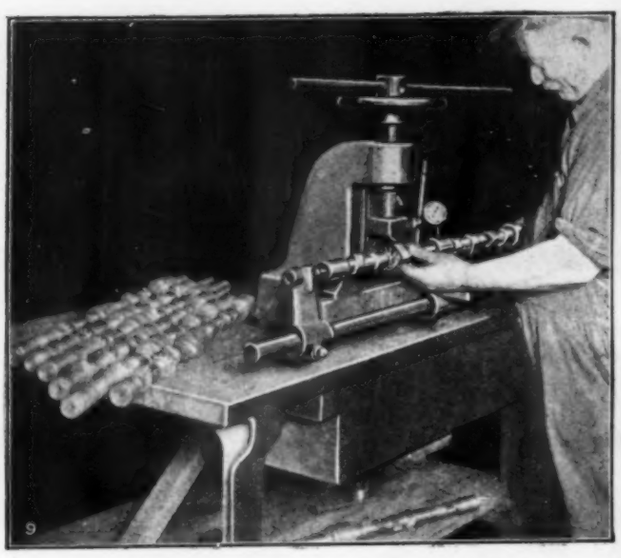


FIG. 9. THE FINAL STRAIGHTENING. FIG. 10. FINAL INSPECTION

large diameters of the three bearings should be noted.

The milling of the spiral gear for driving the oil pump on a Lees-Bradner machine is shown in Fig. 8.

The sides of the cams are then faced, the small diameters undercut and the shaft cut to the proper length and re-centered. Then the fillet radius is cut on the gear, two keyways milled and cotter-pin holes drilled and countersunk. The end threads are cut and the cams rough-ground.

All burrs are then removed with a file, all machine operations inspected and the camshaft is ready to be carburized and hardened, the threaded portions being afterwards annealed. Sand blasting comes next, after which the final straightening takes place as shown in Fig. 9, a convenient hand press being provided for this purpose.

The center bearing is then finish-ground, after which the eight hardened cams are both rough- and finish-ground. The end main bearings and the several diameters that form gear seats are finish-ground. This is followed by a final inspection as in Fig. 10, including scleroscope hardness tests. These tests include the bearings and the cam throws, as can be seen from the apparatus in the same illustration.

How Shall We Designate Tolerances? —Discussion

BY J. A. ROY

Referring to the article by F. C. Hudson on page 794, Vol. 56, of *American Machinist*, entitled "How Shall We Designate Tolerances?" this is a subject which might well be thrashed out and some standard system adopted. The average engineer and draftsman may have (more often he has not) a conception of the uses of tolerances and their expression on working drawings. A tolerance is simply an indication as to the variation from a certain size that is serviceable in the assembled unit, making allowance for the errors which cannot be disassociated from any type of human performance.

The accepted and almost universal method of indicating tolerances, let us say for a hole and shaft is thus: $2.000\ ^{+0.002}_{-0.000}$ in. and $1.997\ ^{+0.000}_{-0.002}$ in., that is, the basic dimension is actually indicated, and nothing smaller than 2.0 in. in the case of the hole, nor anything larger than 1.997 in. in the case of the shaft will be accepted. The workman will naturally have the dimension shown, basic in this case, fixed in his mind and he will work to it and make allowance in only *one* direction. This often results in scrapping or rerouting of work, and always in loss of time.

Let us now consider the results if we indicate the *mean* dimension and give a bidirectional tolerance. The dimensions given above would become 2.001 ± 0.001 and 1.996 ± 0.001 in. The machinist now has an indicated dimension midway between the allowable limits. He consequently works to that dimension and a slight error either way will not cause rejection. If his "mike" or gage should be out a trifle the chances are he will get by. Also the natural wear of the tool point and machine bed and parts, faulty but almost imperceptible alignment of centers, and settling of the machine foundation will, to some extent be taken care of automatically.

This system of indicating tolerances is especially useful in a shop where piecework and time study are in vogue, and where a complete system of working and inspection gages cannot be had, or where only a few pieces are required. The writer speaks from experience when he says he always took the *mean*, and not the *basic* dimension as standard. Any change in dimension could be immediately corrected without repassing the piece through the operation, a most unsatisfactory method where a fairly heavy cut to a close tolerance is required.

And, why in Sam Hill does a draftsman put down ± 0.001 when ± 0.010 would be plenty good enough? And how many were ever guilty of putting down ± 0.500 or even ± 0.250? And why, when ± 0.010 is given will a machinist work to ± 0.0005? I have known some to work to ± 0.0001. It might make a good subject for a psychological investigation, but it has no place in these days of efficiency and maximum production.

Factory Storekeeping and Material Control

The Seventh Article—Storeroom Stowage Rules—Protection of Stores from Fire, Pilfering and Deterioration—Charging and Issuing Maintenance Stores

By HENRY H. FARQUHAR

IN COMPLETING the discussion of storeroom requirements, the methods of stowage, the protection of materials and the handling of maintenance stores must be dealt with. The five general rules given for the physical arrangement and the removal of goods in the storeroom will facilitate the handling and taking of inventory, if strictly observed.

A few definitions of the terms illustrated in Fig. 13 and used in the rules for stowage are as follows:

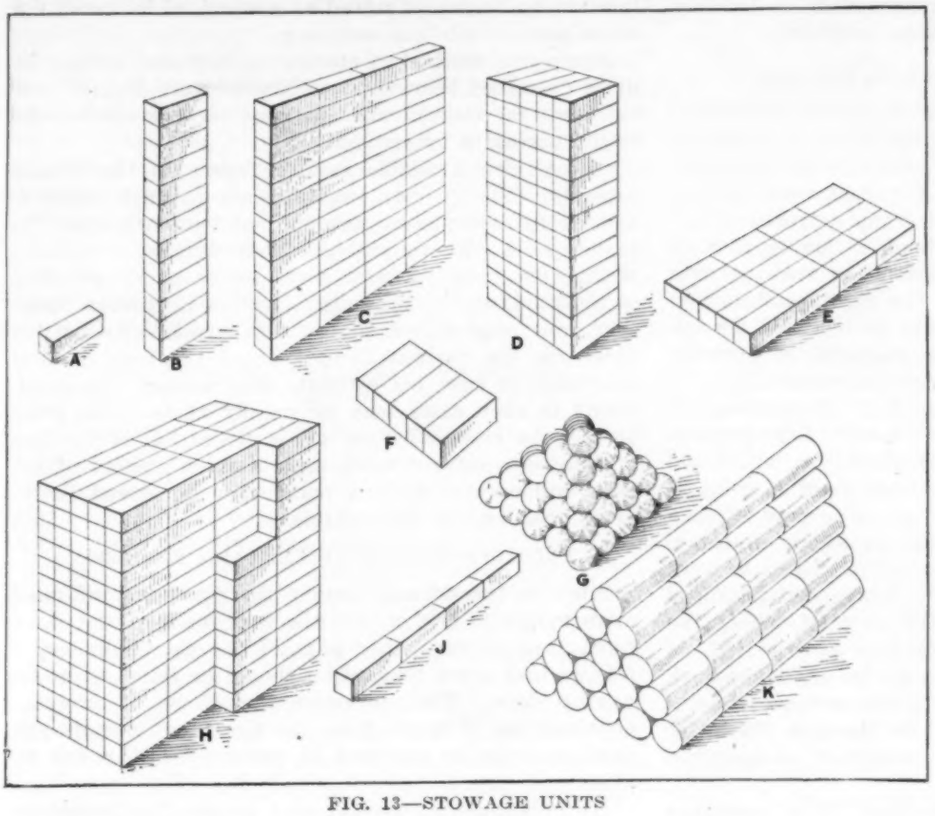


FIG. 13—STOWAGE UNITS

An article is any one kind of material, as machine bolts.

An item is any one size or variety of an article, as hex head machine bolts, U. S. Standard, ½ x 3½ in.

A unit or piece is any single piece, as one bolt, shown at *A*.

A package is a quantity in the original container, as one box of bolts, twelve in a box, shown at *A*.

A lot is a quantity received and stored at any time, as one gross bolts, twelve boxes, twelve in a box.

A standard lot is a quantity determined upon as most suitable for a given condition of use, as fifty bolts.

A column is a number of units or packages in vertical arrangement, one wide, two or more high, one deep, shown at *B*.

A row is a number of units in fore and aft arrangement, one wide, one high, two or more deep, shown at *J*.

A course is a number of units in left and right arrangement, two or more wide, one high, one deep, shown at *F*.

A section is a number of rows in vertical arrangement, one wide, two or more high, two or more deep, shown at *C*.

A tier is a number of rows in left and right arrangement, two or more wide, one high, two or more deep, shown at *E*.

A block is a number of courses in vertical arrangement, two or more wide, two or more high, one deep, shown at *D*.

A stack is a number of tiers in vertical arrangement, two or more wide, two or more high, two or more deep, shown at *H*.

A wedge stack is an arrangement of units in the form of a wedge, as illustrated by the storing of shells, cans and other cylindrical bodies, and as shown at *K*.

A pyramidal stack is an arrangement of units in the form of a pyramid, as illustrated by the storing of cannon balls, and other spherical bodies, and as shown at *G*.

A pile or heap is an irregular mass of pieces, such as a pile of coal.

Instructions for stowage are as follows:

(1) Have a designated stowage place for each item, and so far as possible keep all of that item and no other in that place, properly stowed. When it becomes necessary to place different articles or items, or different lots of the same item, in the same stowage space, separate the piles or stacks by at least 2 in., if in bins, and by at least 5 in., if on platforms or in piles on the floor between the aisles. Be sure that this arrangement is such that it never becomes necessary to remove one item to get at another.

(2) Arrange the items for a maximum facility in taking inventory. In other words, as you face the stowage area from the aisle, commence piling at the back left-hand corner and complete this column to the top; then in front of this build the next column and so on, completing the left-hand section. Similarly, complete the next section to the right, each column being completed so that no vacant spaces will remain hidden, before a new column is started. Only the last column should remain incomplete as shown at *H* in Fig. 13. Place all labels facing the aisle wherever possible.

In taking inventory, multiply the number of packages

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or units per block by the number of full blocks, and add to this the number of packages in the incomplete section. For a wedge stack:

Number in a block = number on bottom tier × (number of tiers + 1) ÷ 2.

In some cases stowage may be arranged so that the taking of inventory is accomplished in even less time than this. It is often possible with articles which occupy space in direct proportion to quantity, to establish a scale or gage at the side of the stack, bin, carboy or other container, which, at a glance, indicates with sufficient accuracy the quantity on hand. Familiar examples of such scales of quantity are found in coal pockets and in lumber sheds. The general method is applicable to the measurement of many other materials if a suitable means be devised.

(3) Provide for securing a turnover of stock. The methods of doing this will vary somewhat as between single and double binning, stacking or piling.

Single and Double Stacking Systems

In single stacking always issue from the right-hand side of the stack. Starting with the incomplete section, as shown at *H* in Fig. 13, work in the opposite direction (to the left) from that in which the stack was built up. Remove each column and section completely before another is disturbed. If stacks tend to topple over, it may be necessary to remove the items by tiers, leaving the top of the stack instead of the right-hand section incomplete. The procedure should be modified accordingly. This, however, is more wasteful of stowage space and should not be done unless necessary.

When a new lot of the same item is received, as directed in Rule No. 2, pile it to the left of the present lot, removing the left-hand sections of the latter and putting these packages on the right-hand side as it becomes necessary to provide room. The new lot may be placed flush with the old one in single stacking, unless it is desired for identification purposes to keep the two lots physically separate. Leave odd packages on the right-hand section of the new lot where the separation of lots is necessary, or use more of the old lot to fill in the new stack where stacks are to be flush throughout. Where it is impracticable or too expensive to move the old lot to make way for the new, the latter may be piled to the right of the present lot as described in the next paragraph.

Where double stacking is practiced, it is necessary always to have space for two stacks, one from which all issues are made, the other to which all receipts are added. Each stack is built up as explained in Rule No. 2, and between the two, a vacant space of not less than 5 in. should ordinarily be left. Withdrawals are made from right to left of the issuing stack as explained, and when the issuing stack is exhausted, issuing should start from the previous incoming stack, and future receipts should be put in the space just left vacant. Where it is desired to keep each lot separate, here again the procedure must be modified as suggested for single stacking. Which stack or lot is outgoing and which is incoming at any particular time is indicated by the difference in bin tags, or by a marker, if desired.

(4) Establish standard lots for the stowage and issue of materials wherever practicable. Unfortunately, it is seldom possible to make the trade container, box, keg, or carton, at once our unit of purchase, stowage and issue throughout, although this should be done wherever possible. In such cases, the container need not be opened until it reaches the point of use, except for inspection and for possible treatment against rust. Clerical work in such cases is much simplified, since the transactions relate to a few packages containing many units.

Where the use of the original container is not possible, however, it will facilitate issuing and quick service if, instead of putting the units back in the original containers or storing them loose in bins at the time of inspection, they are divided off when being counted into predetermined standard amounts which, as separate lots, are suitable for delivery to the point of use. Such items as bolts and nuts, screws, special castings and so on may always be needed in certain definite quantities for the assembly of a standard product. This quantity should be sorted into suitable boxes or put into strong bags and stored as a standard lot ready for issue without further counting.

Again, the method of storing in bulk and issuing by units described below under "Maintenance Stores" will cut down the clerical work incident to book entries and to the taking of inventory.

(5) Utilize available stowage space to the utmost capacity. Study your requirements in each material and try to have just enough and not too much space for each article. By providing standard racks and interchangeable bins, by leaving vacancies every so often at the start, and by providing overflow bins when necessary, one may afford to be very miserly in allotting space for the various items without the fear of later confusion in case his estimate was wrong. Readjustments in such cases may be readily made. The great obstacle to more effective space utilization is the lack of data showing how much space a given number of any item will occupy, or how many may be stored in the given space which is available.

Precautions Against Fire and Explosion

Since in the normal factory the equivalent of much more money is held within the four walls of the storeroom than in any other part of the establishment, it follows that every precaution should be taken to insure against loss. The storeroom should be of fireproof construction, if practicable. In any event, certain precautions must be observed to prevent loss through explosion or fire.

No inflammable material, such as gasoline, powder or dynamite should ever be allowed in the storeroom itself. Such material should be stored in an isolated position away from all buildings.

Within the storeroom, cleanliness should be absolutely insisted upon. Oily waste, paper, burlap, and all materials which are subject to spontaneous combustion, or which would readily serve to feed an incipient blaze, should be rigorously excluded from the storeroom, except as they may be brought there, or as they may accumulate temporarily, pending prompt disposal.

All aisles must be kept absolutely clear of permanent obstructions. The only obstruction which should be permitted in any aisle is that caused by men and trucks actually in the process of delivering goods. When a truck has been emptied or filled, it must not be allowed to clog up the aisle, but should be taken immediately to the designated position. The possibility of controlling a fire should not be lessened through unusual obstructions.

It goes without saying that the most modern overhead

sprinkler system should be installed. Particular care must be taken, furthermore, to see that the sprinkler has a chance to perform properly through having plenty of room between sprinkler head and piles of material. Having determined the minimum head room which should be left, constant vigilance through systematic inspection is necessary to prevent storeroom attendants from encroaching upon this space.

An ample supply of hand fire extinguishers should be provided at convenient points. An incipient blaze may be put out through the use of such extinguishers before it has become sufficient to start the sprinkler heads. As an extra precaution, a hose should be provided, which is connected to a head other than that to which the sprinkler system is attached.

As to the use of wood instead of steel storage racks and bins, little can be said as regards insurance rates because conditions vary so widely, making individual appraisals necessary in each case. For instance the difference in rates in any given case between sprinklered and unsprinklered storerooms is very much in favor of sprinklers, and this holds true in general regardless of what kind of storage equipment is used. In unsprinklered storerooms the use of metal equipment might amount to as much as a 20 per cent saving in rates over wood equipment in some cases, whereas in others the saving would be negligible. With the use of sprinklers, however, which is the only safe method, there appears to be little choice between metal and wood equipment as far as the insurance rates go.

How Deterioration and Pilfering Are Avoided

All material subject to deterioration through rust must be treated by some one of the numerous preparations available for this purpose. It must be remembered that the chemical decomposition of metals takes place much more rapidly during the warm, humid days of summer, and particular attention is necessary at this time. Parts which are to be held in storage more than a week should be given a coating of a rust preventative.

Specifications, tests and prices of the various rust preventing agents may be obtained from the vendors, as may also the machines and solutions by which these agents may be easily removed. Care must be taken to secure an agent which does not readily evaporate and which does not corrode or otherwise injure the surface of the metal.

In the discussion of double binning methods, it was emphasized that one of the prime advantages to be derived through this method was the insurance of a turnover of stock. Even with double binning, however, the turnover may be insufficient to prevent rust and this method must be looked upon as a supplement to, and not as a substitute for, the use of rust-preventing agents.

In the case of materials such as rubber, which harden and become useless with age, and in the case of certain oils which solidify if left standing too long, the double binning principle comes fully into its own. As explained in the previous installment under the discussion of double binning, the provision of one bin or aisle for all incoming material with the use of the adjoining one for all issuing, is the only sure way to provide automatically and systematically for a regular turnover of stock. Since double binning requires somewhat more space than single binning, the principle may be used, of course, for the storage of this kind of goods, while those not subject to rapid deterioration may be single binned. The only loss in the latter case is the loss of accuracy of inventory, a sufficiently important consideration, however, in all cases.

The prime prerequisite to prevent deterioration from dust is to keep the storeroom thoroughly cleaned and to provide dustproof racks for such articles as stationery, which would be ruined should they become the least bit dirty. The standard racks and bins described and illustrated previously are entirely adaptable to closed cabinets and many such racks are in use today for the dustproof storage of many different articles.

The success with which so many plant activities may be controlled hinges at many points on the accuracy of the inventory. Consequences have at times been very distressing when we thought we had one hundred pieces on hand and found there were actually only eighty-five. Our accounting statements, furthermore, are misleading unless our inventory of materials and work in process is correct. Primarily, in order that we may maintain any semblance of control and only secondarily because some among us have the habit of pocketing that which does not belong to us, we must have a locked storeroom. The psychological effect, furthermore, is excellent.

The temptation to petty theft is particularly strong in the case of such handy household articles as tacks and hammers, electric light globes, ink, paper, mucilage, and similar items. If such articles are left where they may be easily slipped into one's pocket for home consumption, it is inevitable that that is what will happen to many of them. Such temptations should be removed.

This does not mean, however, that we are to be parsimonious in furnishing supplies, or even that we may not adopt a liberal policy in supplying at cost such articles as the individual employees may desire. With the locked storeroom and a tight rein generally, accompanied by a judicious amount of what workmen are usually pleased to regard as "red tape," most of the needless requests and petty takings will disappear of themselves. A liberal policy in these respects may neutralize what might otherwise be called an irksome system. It simply means that we must know at all times where we stand and that insistence must be placed upon the locked storeroom, the written requests, and the approval of some responsible official before articles are furnished for private consumption.

Handling Maintenance Stores

The adequate handling of the supplies used in the upkeep of a plant offers peculiar problems and difficulties because of the emergency nature of much of the maintenance work. Some factories have made great strides in standardizing current inspection and repairs, and in planning and even in paying bonus on the operations performed by this department. But there is an irreducible minimum of hurry-up jobs which constantly places the retention of a system in the maintenance storeroom to severe tests.

On one hand, to maintain any semblance of control of inventory and of issue, a certain amount of systematic routine must be insisted upon. On the other hand, a few seconds delay when a steam pipe or water main bursts, is not to be tolerated. The question is how to secure control and avoid delay. Reference is made to preceding discussions of such matters as organization, layout, the provision of adequate equipment, including standard interchangeable racks and bins properly indexed with cross references, and operated by double

binning methods. These are all features of good storeroom management, doubly important in this case.

In addition to these matters, I wish to suggest briefly the means by which the work of the maintenance department may be speeded up, and yet may be controlled in two features of its work, which ordinarily cause the most concern, namely, the handling of supplies and spare parts, and the checking in and out of tools.

It is needless to emphasize the fact that the regulation of replenishment, follow-up, inspection, storing, and balance sheet control previously described is doubly important in the case of items which have such a potential possibility of causing disaster through an insufficient or unsuitable supply, as have most of the articles carried in the maintenance storeroom. Because of the nature of the supplies, it also follows that a liberal policy as regards the amount of inventory must be adopted. This policy must be reflected in the setting of low limits and amounts to order, and to such a plentiful allowance must be added constant vigilance.

In a previous installment, under departmental supplies, two alternatives in charging or allocating the cost of the materials issued to the proper account, were indicated as follows:

(1) Departmental supplies may be charged to departmental expense, to be taken up in the overhead.

(2) Departmental supplies may be charged to specific jobs when desirable from a cost-finding standpoint.

In the case of the maintenance department supplies, both methods are usually desirable—the first for small inexpensive items, the second for expensive or special materials which the particular job served should carry. In cases where the reserve supply of stocked items is kept in a central storeroom from which small, current supplies are issued, the above procedure is applicable.

Where this is not the case, but where the whole supply of parts needed for maintenance is stored in the maintenance storeroom, a slightly different procedure is necessary, in order that the best results as a whole may be obtained and that the desired charges may be made between those to be charged to departmental expense and those to be charged to special expense.

The following procedure will be found effective for those supplies to be charged to departmental expense when issued to the workman. A reserve supply will be kept in one bin, in original packages or in other bulk lot as is desirable. On this supply the regular procedure described for the central storeroom will operate. In other words, for each item there will be a balance sheet that controls replenishment and records all transactions, and a bin tag on the bin will be operated as described. Back to back or alongside of this main bin will be another smaller bin which is used for direct issue to the workman. When the latter becomes empty, a transfer in bulk will be made from the main bin, and at that time a stores issue will be made for the quantity transferred, charging the amount to the departmental supplies. The articles will be placed loose in the issuing bin, from which the issues may be made without a further record.

For materials to be charged to a specific job number, either those materials purchased specially, or those of considerable value, the proper charge is unknown until the use is known. Where this use may be ascertained previous to issue, the stores issue may be filled out and placed aside with the article until it is called for, which will expedite action in delivery. But on a hurry-up job there is nothing to do but give out the material as called for and attend to the issues later. By following the procedure indicated, however, the paper work at the time of issue may be reduced solely to rush jobs—a small proportion of the work in well-run departments.

A similarly simple procedure covering tools will give the speed and definiteness essential for effective work. Each tool, of course, must have its own location, which must be so indexed and cross-indexed as to make it possible for a stranger to find any tool in a very few moments, no matter whether it is in its rack or in the hands of some mechanic in one of the departments of the plant.

SF 7 AS L. M. CO.

CHECK NO._____

QUANTITY WANTED | SYMBOL OF TOOL WANTED

DESCRIPTION OF TOOL WANTED

Month	Day	Year	Signed by man receiving tools.

NOTE. ONLY ONE KIND OF TOOL CAN BE ISSUED ON THIS CARD. BUT SEVERAL OF THE SAME KIND.

FIG. 14—CHECK FOR TOOLS AND FIXTURES

The tool racks must be plainly lettered according to a systematic scheme. A card index of each tool refers to the rack where it is stored. When a mechanic desires a tool he comes to the window and fills out and signs the tool check shown in Fig. 14. The attendant issues him the tool, files the check by the tool symbol and in the compartment with the mechanic's number on it files a tag on which this tool's symbol is stamped. The whole transaction should take but a moment. Looking at the files of checks, one may see just who has any particular tool and where he has gone with it, in case a hurried recall is desired. Looking at the man's compartment, one may see just what tools are now in his possession.

As Told by the 1919 Census of Manufactures

The table below gives some facts of more than passing interest that were gathered from the 1919 census of manufactures. After eliminating the wages and material, the amounts left per wage earner for profit and overhead are as follows:

	Wages per Wage Earner	Profit and Overhead
Machine tools	1,250.00	1,643.00
Automobiles	1,486.00	2,367.00
Railroad cars	1,505.00	1,998.00
Cash registers and adding machines	1,366.00	3,063.00
Locomotives	1,436.00	1,771.00
Power pumps	1,351.00	1,437.00
Crude iron, steel and rolled products	1,705.00	1,464.00
Engines	1,359.00	1,826.00
Safety razors	.....	3,139.00
Saws	.....	2,434.00
Shovels, spades and hoes	.....	2,360.00
Machinists tools	.....	1,598.00
Machine shops without foundries	1,292.00	1,683.00
Machine shops and foundries combined	1,257.00	1,534.00
Foundries alone	1,343.00	998.00

From the above it would seem that it pays better in the matter of tools to make shovels and scoops and saws than it does machinists' tools. Also, that it is an expensive luxury to run a foundry. Likewise that a machine-tool shop does not afford as much for profit and overhead as just a plain machine shop, and certainly not as much as an engine shop; nor an automobile shop; nor a railroad car shop; nor a locomotive shop; and that many other metal-working industries seem to be able to pay more than the machine-tool shop can pay for wages, and still have a lot more left for profit and overhead. Evidently the machine-tool shops have been more modest in their demands on their customers.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Three Methods of Storing Material

BY HERBERT CRAWFORD

There are many methods of handling and storing material, each adapted for some particular place, and from which we can select the most suitable for other similar conditions. The illustrations herewith show three methods used in different parts of the plant of the Peerless Motor Car Co., Cleveland, Ohio.

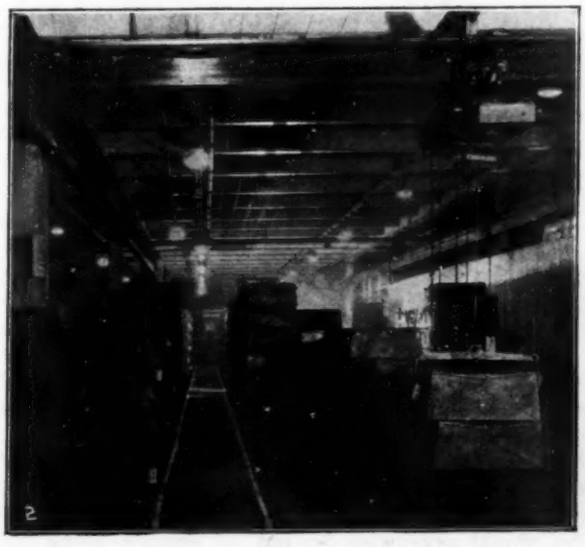
The first, Fig. 1, shows a very substantial rack of structural steel for storing bar steel for the screw machine and other departments. This rack needs no special description. It is simply well built of shapes and sizes suitable for the loads to be carried. It is located in the center of the building, beneath the first floor, both to secure a firm foundation and to avoid obstructing light from other departments.

FIG. 1—SUBSTANTIAL STEEL BAR STORAGE RACK

In Fig. 2 is shown a storage room for finished and semi-finished parts, large steel tote boxes being used as containers. The boxes are handled by means of a suitable sling and an electrically operated overhead crane. The stacking of the boxes is carefully kept inside the painted lines designating the aisles. This keeps a clear passage for men and trucks and also makes a path for the load on the crane in carrying boxes from one point to another, or in delivering them to some other department as the work progresses. These boxes can be piled seven deep so that a large amount of material can be stored in a small floor space without presenting a crowded appearance.

An entirely different type of storage and handling apparatus is shown in Fig. 3. This is for handling and storing frames in any one of three rows. The gantry crane has a runway which overhangs the legs at each end so that stacks of frames can be piled either in rows *A*, *B* or *C* as desired. As the track on which the crane runs extends to the building behind it, a great many frames can be piled in each of the three locations. The frames are handled in lots of seven and are usually piled fourteen deep. The three lines of storage can easily take care of a thousand or more frames without exceeding the height of piling shown, and this can even be doubled if necessary to take care of an emergency or other condition.

The storage yard is adjacent to the chassis assembling shop so that a stack of frames is simply picked up from the storage piles, lowered on to the small truck *D* and pushed into the assembling shop at the right. This makes a very compact and convenient storage arrangement and saves space in the stockroom.



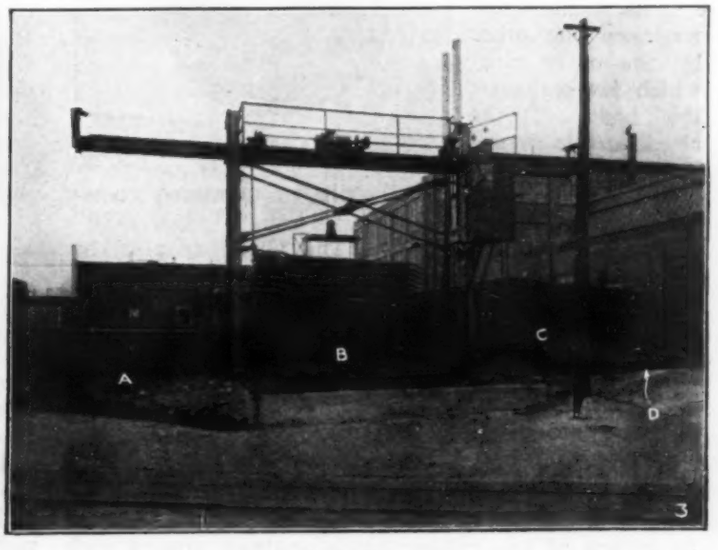


FIG. 2—TOTE BOX STORAGE. FIG. 3—CONVENIENT FRAME STORAGE

A Double Collet Chuck

By Milton Wright

An adaptation of the collet chuck principle to the holding of quill gears is shown in the accompanying illustrations. The piece to which it is adapted is familiar to all who have had occasion to "look into" the transmission of an automobile, and consists of three gears of different diameters cut upon a single piece of metal.

These quill gears are heat-treated and, in the better class of machines, ground after hardening. The grinding operations include the teeth of the large gear but because of the smaller diameter and close proximity to the large one, the teeth of the small gears cannot be reached by the grinding wheel.

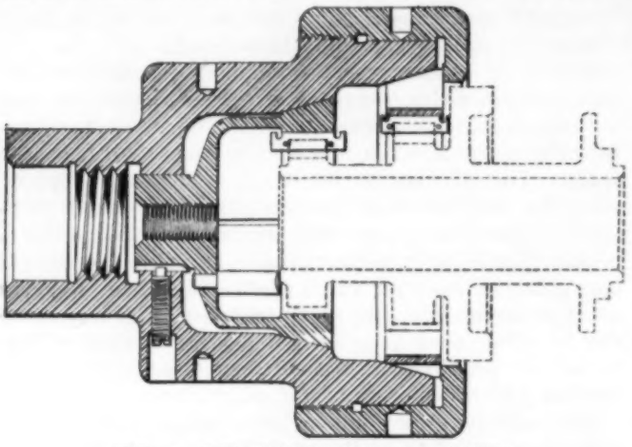


FIG. 1—SECTIONAL VIEW OF CHUCK

The chuck, shown in section in Fig. 1, was designed for the purpose of locating this piece from the pitch circles of both the smaller gears and thus compensate for any slight error, caused by distortion in hardening, that might exist in either. For this purpose two collets are provided, one to be closed by means of a draw bar and handwheel upon the rear end of the spindle in the usual way and the other by the outer ring, which screws upon the body of the chuck and is turned by means of a bar. The piece, set up ready to go in the chuck, is shown in Fig. 2. The plugs, or pins, by means of which the chuck is enabled to reach the pitch circles of the gears, are first made as round pieces of the proper diameter and are then wired in place upon a finished gear (before the latter is hardened), and a part of their surface ground away to conform to the circles presented by the inner surfaces of the respective collets.

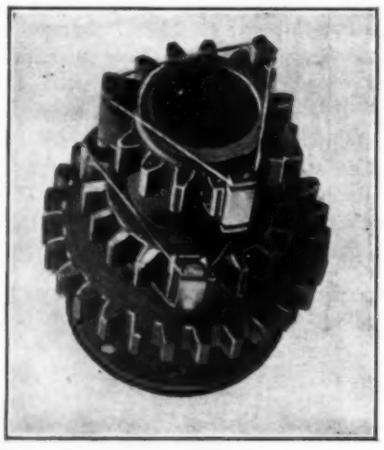


FIG. 2—THE WORK READY TO GO IN THE CHUCK

Notches are made in both ends of each pin so that in setting up for the final grinding of the bore of the piece the pins are placed in their respective positions and held by means of two rubber bands snapped around each

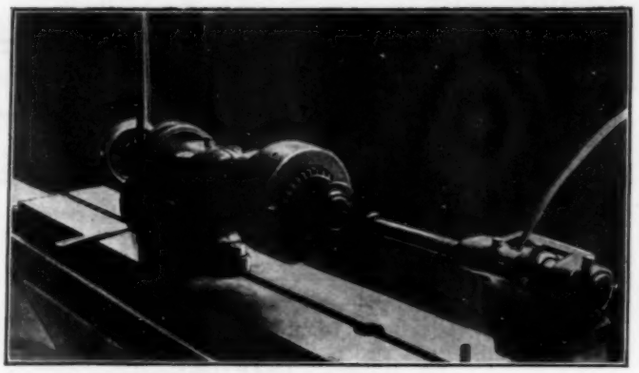


FIG. 3—THE CHUCK UPON THE GRINDING MACHINE

set. The work can then be handled into and out of the chuck as a unit.

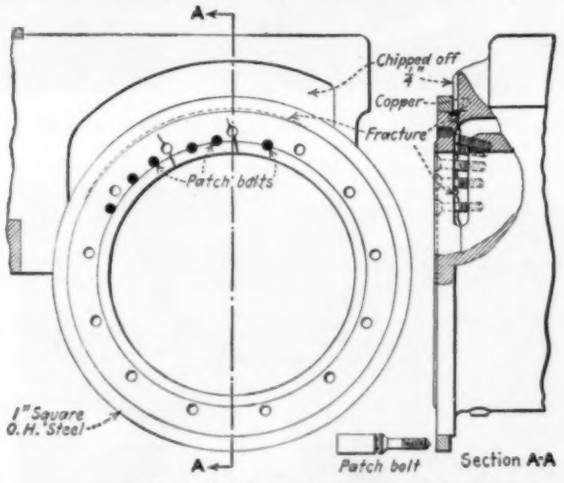
The chuck is used upon the work spindle of an internal grinding machine as may be seen in Fig. 3. Though in this picture the large gear appears to be within the chuck, it does not actually touch it, the piece being held entirely by the grip of the collets upon the pins.

The chuck was designed by G. E. Peterson, superintendent of the grinding department for the Pratt & Whitney Co., of Hartford.

Repairing a Broken Locomotive Cylinder

By F. M. A'Hearn

A broken piston rod on a passenger locomotive resulted in forcing out a front cylinder head and cracking the end of the cylinder for a distance of some 15 in. circumferentially, the crack commencing in the front steam port and extending outwardly to the vertical surface above the port, terminating in a line almost concentric with the cylinder flange. The radius of the crack was from ⅛ to ¼ in. larger than that of the flange and extended approximately the entire length of the port. The crack was opened ⅛ in. at the inside which brought the cylinder-head seat through the broken zone a corresponding amount above the remainder of the joint. The section was also cracked radially at two stud holes, all of the fracture appearing as shown in the accompanying sketch.



HOW THE CYLINDER WAS REPAIRED

There appeared to be a possibility of drawing the broken section back into its original position and making a satisfactory job, the saving of time the locomotive would otherwise be out of service being the

point that decided the matter, although it would be necessary to reinforce the cylinder flange by the use of a band shrunk around it which would cover the fracture in such a manner as to make any method of caulking a difficult matter. It was found that if the vertical surface was chipped away a small amount the crack would terminate on the extension of the cylinder flange thus formed.

A row of patch bolt holes was drilled at an angle with the bore of the cylinder, the object being to have the heads of the patch bolts outside of the cylinder-head joint and to screw the bolts into the cylinder body between the steam port and the bore of the cylinder. With the patch bolts screwed in, the broken section was drawn back very nearly to its original position. The vertical surface along the line of the break was chipped back ¼ in. and a groove $\frac{5}{16}$ x $\frac{5}{16}$ in. was chipped the length of the crack, care being taken that the crack terminated in the groove so made. A piece of square copper was fitted into the groove and fullered tight, the band was shrunk on and the patch bolts again tightened to take up any slack gained by shrinking the band. The shanks of the bolts were next cut off and the heads caulked tight. The cylinder joint was found to project slightly along the broken zone necessitating some scraping and grinding.

When tested under working pressure the copper strip leaked in several places but was easily caulked, the space between the band and vertical face of the casting being sufficient to permit the use of a thin fuller. The radial cracks were not visible after the band was applied and did not leak when tested.

When consideration is given to the value of a new locomotive cylinder, it is apparent that a study of the various methods of repairs is time well spent. It requires no skill or intelligence to scrap a broken piece but often requires good judgment to make repairs.

Testing Gears by Micrometer Measurement

By S. O. Gordon

The accompanying formulas may prove useful to the reader for checking the pitch diameter of gears. It may be well to note that this method is also useful for finding the distance from the center of the gear, and for calculating the sizes of pins for locating the gear in a chuck.

Two plugs with centers *B* and *L*, are placed in opposite or nearly opposite tooth spaces as shown in the accompanying illustration, and are of such a diameter that they touch the teeth at the pitch line. A micrometer measurement is taken over these plugs and from the accompanying formulas the error in the actual pitch diameter of the gear is figured. It is necessary to calculate the size of the plug for each size of gear, even though the diametral pitch is the same.

Referring to the accompanying illustration, *C* is the center of the gear, *CB* the center line of the tooth space, *F* the point where the tooth curve cuts the pitch circle. The line of action, *BFE* is tangent to the base circle at *E*. A part of this line, *BF* is also the radius of the plug. The angle *FCE* or α is equal to the pressure angle.

D = pitch diameter; N = number of teeth;
M = micrometer measurement for an even number of teeth;
X = micrometer measurement for an odd number of teeth;
A = distance between plug centers for an odd number of teeth;
Z = diameter of plug;

$$\delta = \frac{360^\circ}{4N} = \frac{90^\circ}{N} \qquad \gamma = \alpha + \delta$$

The triangles *CEF* and *CEB* are right triangles.

$$CF = \frac{D}{2} \qquad CB = V$$

$$CE = \frac{D}{2}\cos\alpha \qquad V = \frac{CE}{\cos\gamma}$$

$$V = \frac{\frac{D}{2}\cos\alpha}{\cos\gamma} = \frac{D}{2}\cos\alpha\sec\gamma$$

$$W = V\sin\gamma$$

$$Y = \frac{D}{2}\sin\alpha$$

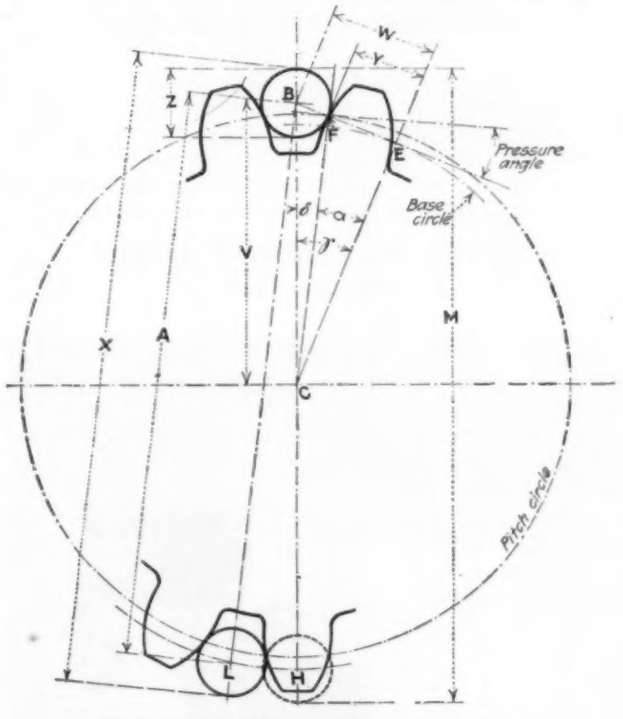
$$Z = 2\,(W - Y) = 2\,V\sin\gamma - D\sin\alpha$$

$$Z = D\,(\tan\gamma\cos\alpha - \sin\alpha)$$

$$M = 2\,V + Z$$

$$M = D\cos\alpha\sec\gamma + Z$$

The illustration is made for an odd number of teeth, but when the gear has an even number of teeth, the



GEAR MEASURING PLUGS IN POSITION

tooth spaces and, therefore, the pins, are directly opposite each other. The center of the pin opposite to *B* is at *H* which, in this case would be on the center of a tooth space instead of a tooth as shown.

$$M = 2\,V + Z \qquad M = D\cos\alpha\sec\gamma + Z$$

For an odd number of teeth a little further calculation is necessary.

$$BH = 2\,V$$

The triangle *BLH* is a right triangle, being inscribed in a semicircle.

Angle $HBL = \frac{90^\circ}{N}$ = angle δ.

$$A = BH \times \cos\frac{90^\circ}{N} = 2\,V\cos\delta$$

$$X = A + Z.$$

$$X = D\cos\alpha\sec\gamma\cos\delta + Z$$

For example, to find the diameter of the plug and the micrometer measurement for a gear with 20 teeth, 8 diametral pitch, 2½-in. pitch diameter, 14½ deg. pressure angle:

$$\alpha = 14\tfrac{1}{2}^\circ \qquad N = 20 \qquad D = 2.5$$

$$\delta = \frac{90^\circ}{N} = 4\tfrac{1}{2}^\circ$$

$$\gamma = \alpha + \delta. \qquad \gamma = 14\tfrac{1}{2}^\circ + 4\tfrac{1}{2}^\circ = 19^\circ$$

$$Z = D\ (\tan \gamma \cos \alpha - \sin \alpha)$$

$$Z = 2.5\ (0.34433 \times 0.96815 - 0.25038) = 0.20745 \text{ in.}$$

$$M = D \cos \alpha \sec \gamma + Z$$

$$M = \frac{2.5 \times 0.96815}{0.94552} + 0.20745 = 2.76727 \text{ in.}$$

For example, to find the diameter of the plug and the micrometer measurement for a gear with 25 teeth, 10 diametral pitch, 2½-in. pitch diameter, 14½-deg. pressure angle:

$$\alpha = 14\tfrac{1}{2}^\circ \qquad N = 25 \qquad D = 2.5$$

$$\delta = \frac{90^\circ}{N} = 3^\circ\ 36'$$

$$\gamma = \alpha + \delta = 14\tfrac{1}{2}^\circ + 3^\circ\ 36' = 18^\circ\ 6'$$

$$Z = D\ (\tan \gamma \cos \alpha - \sin \alpha)$$

$$Z = 2.5\ (0.32685 \times 0.96815 - 0.25038) = 0.16514 \text{ in.}$$

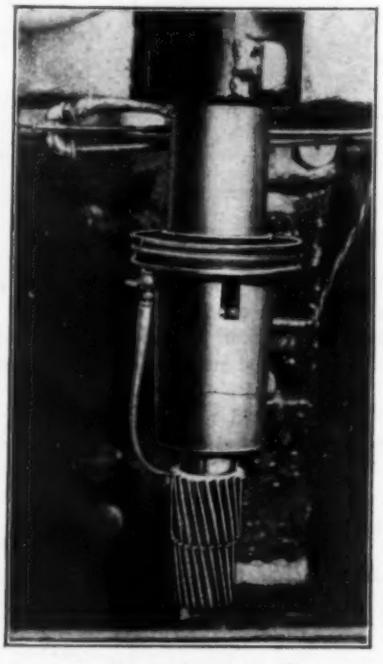
$$X = \frac{D \cos \alpha \cos \delta}{\cos \gamma} + Z$$

$$X = \frac{2.5 \times 0.96815 \times 0.99803}{0.95051} + 0.16514 = 2.7064 \text{ in.}$$

Carrying the Lubricant Around with the Tool

BY HENRY M. CLARY

The foreman having decided that the boring and reaming tools used for boring out some large work on a heavy two-spindle drilling machine were not getting enough oil, he had the tinsmith make up the arrangement shown in the photograph. A band of sheet metal was cut to a length that would just go around the spindle of the machine, and of a width of about 1½ in. Then a similar band was cut, except that it was made enough longer so that it would be about 3 in. greater in circumference, and a disk was cut out and soldered in for the bottom. The center was cut out, of course, so that the spindle could pass through. Then this cup, or pan, was cut through one side so that it could be placed around the spindle, and the ends were soldered together again. This was necessary because it could not be slipped over the spindle nose, due to the fact that the nose is larger than the other part of the spindle.



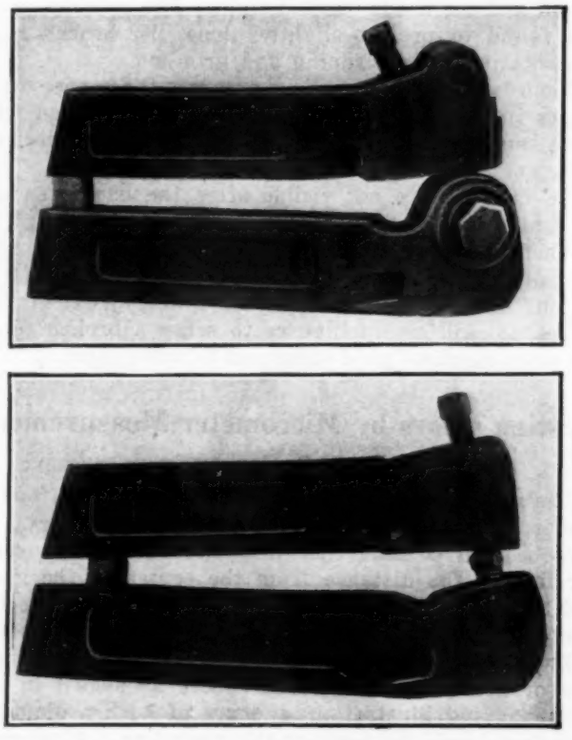
LUBRICANT-CARRYING PAN ATTACHED TO MACHINE-SPINDLE

A petcock, to which a long spout had been soldered as shown, was soldered into the bottom of the pan, and the lower end of the pipe through which the lubricant flows from the tank was placed so that the lubricant could run into the pan. As the spindle of the machine turns, the pan turns with it, feeding lubricant to the point of the tool. Or if a reamer is used, as shown in the photograph, there is no doubt that the lubricant reaches every part of the hole.

Salvaging Toolholders by Brazing

BY GEORGE WILSON

In an effort to improve the ordinary setscrew type of toolholder and at the same time secure one that might use the toolbits to shorter lengths, it was decided to try different makes and designs selected from the catalogs. The shop was not long in rendering a most emphatic opinion, with the result that a considerable number of socalled "improved" toolholders were relegated to the scrap pile in favor of the old standby, the plain setscrew.



TOOLHOLDERS BEFORE AND AFTER BRAZING

As the toolholders represented a considerable cash outlay it was decided to try salvaging by brazing up the "works," shaping off the protuberances and putting in setscrews in the usual manner. After this was done and the surplus brass cleaned off so that the steel was exposed, the pieces were reheated to a low red, just hot enough so that the brass would not run out of the cracks, smeared with cyanide and quenched.

A good many toolholders have the habit of breaking the bits under pressure of the screw, due to a hollow under the screw. Before casehardening these tools the bottom of the hole was filed, to insure straightness. The illustration shows the toolholders before and after brazing.

Finish Boring Connecting Rods and Crankcase

By Herbert Crawford

The device used by the Peerless Motor Car Co., Cleveland, Ohio, for finish-boring the connecting rod so as to leave 0.001 in. for the final scraping and fitting is shown in Fig. 1, and in detail in Fig. 2. It consists

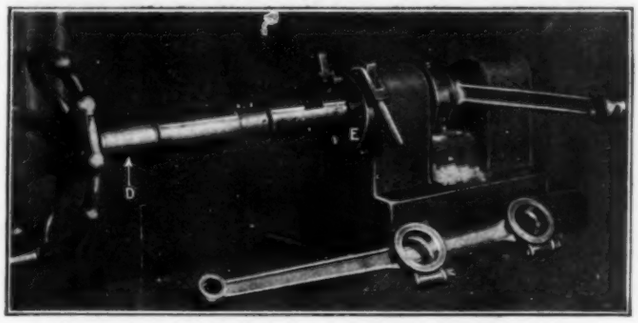


FIG. 1. FIXTURE FOR FINAL BORING

of a substantial block with a bearing on each side of the rod, each bearing being fitted with a steel sleeve which guides the boring bar. The nut *A*, which is threaded on the end of one sleeve, is first used to clamp

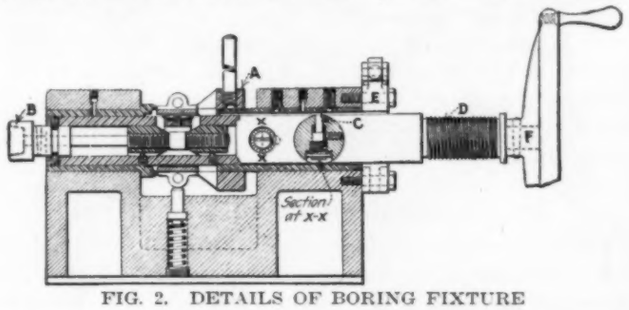


FIG. 2. DETAILS OF BORING FIXTURE

the rod lightly in place. The bar is then slipped through so that the six centering plungers are inside the bearing as in Fig. 2. They are forced out by the knob *B*, centering the bearing with the bar. The connecting rod is then clamped tightly in position by nut *A* and the centering plungers withdrawn by knob *B*.

The boring bar is then moved forward so as to bring the cutting tool *C* in position to bore the bearing. This brings the threaded portion of the bar *D* in position to be engaged by the split nut *E*, providing a feed of 32 per inch to the boring tool. The bar is then fed through by hand with the wheel *F*. The cutting tool has micrometer graduations for feeding it into the work.

A somewhat similar device is used for finish-boring the crankshaft bearings as shown in Fig. 3. The cylinder block rests on one cylinder face in the fixture at *A*, and the plug *X* fits into the camshaft hole being held by clamps *B* and *C*. A center-bearing *D* projects up from the base to support the bar, in addition to the end supports *E* and *F*. The bar has disappearing cutters as shown in the bar in Fig. 2, and is also fed by a screw at *G* having 20 threads per inch, using the crank handle *H* for turning. A split nut at *I* allows for a quick return of the bar, also for rapid movement between the bearings.

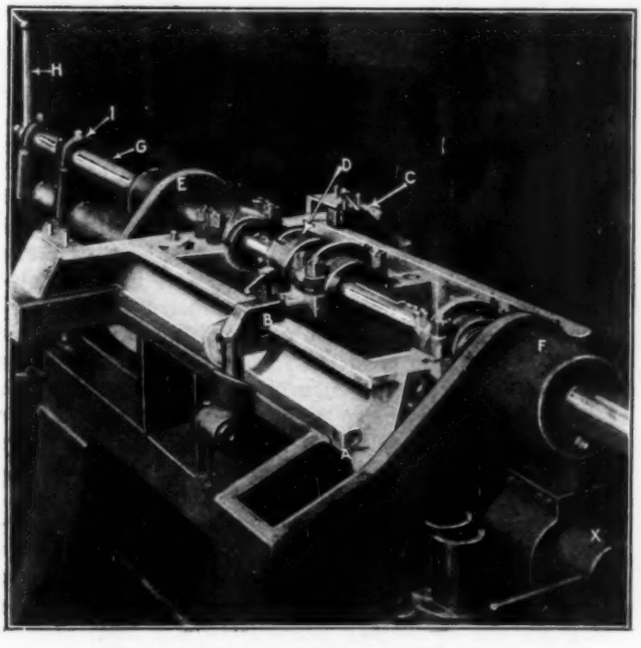


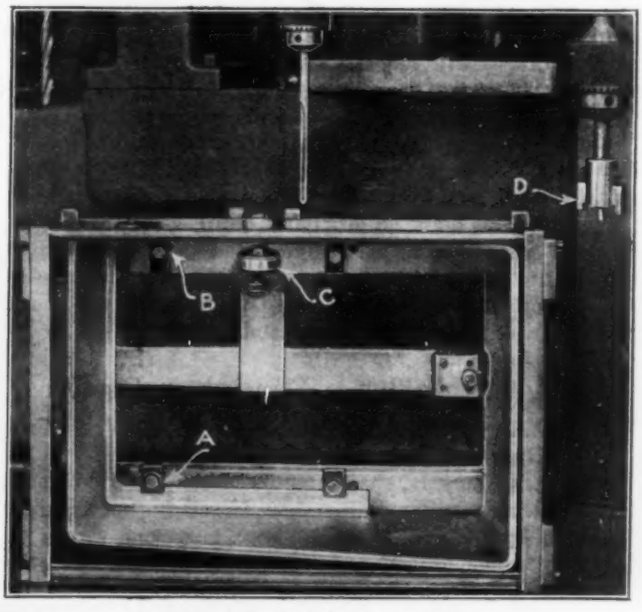
FIG. 3. BORING CRANKSHAFT BEARINGS

Drilling a Large Die-Casting

By R. E. Marks

The illustration shows one of a lot of very large die-castings used by the Monroe Calculating Machine Co., Orange, N. J. The reason for die-casting this part was not to eliminate machine operations but to insure a solid and reliable aluminum casting of thin section.

This casting forms the case of a calculating machine and measures 15 x 12¼ x 4½ in. and weighs 2 lb. 6 oz. As shown it is being drilled in a fixture of very light con-



DRILLING A LARGE DIE-CASTING

struction so as to secure easy handling. The skeleton construction is of interest as an example in fixture design. In addition to being supported on the outside, the flange is clamped on the inside as at *A* and *B*. The side of the case is also supported against the thrust of the drill by the arm *C*. A large hole in one position, for the crank operating-handle to go through, is cut by the trepanning tools shown at D, a pilot hole being first drilled as usual.

Editorial

Shop Economies Aside from Cutting Speeds and Feeds

IT IS a common failing when attempting to reduce costs to consider only the time required for machining a piece of work. Increased cutting speeds and feeds are not to be overlooked, but in many cases the time taken in handling work exceeds that of cutting.

The keeping of sufficient material ahead for the constant operation of machines is also a vital factor in economic production. This involves not only ordering in ample time from concerns with a reputation for prompt delivery, but in storing the material where it can be readily found, starting it out of the stockroom on time and having a system which moves it promptly to the machine.

When it comes to the machines themselves we are confronted with the problems of easy handling from the floor or bench, and the designing of fixtures whereby the work can be accurately, easily and quickly clamped ready to be machined. Ease of cleaning out chips, which prevent accuracy, is an important matter. If the time taken in loading keeps the machine idle, the advisability of using duplicate fixtures, or of reducing the idle time in other ways, should be considered.

Nor should the inspection and assembly be overlooked as both can very frequently be speeded up more than many realize. Some of our best shops are using piece-rate and bonus very effectively in the inspection of parts. They claim not only a greater output but a much more careful inspection. For a super-inspection penalizes both the passing of poor work and the rejection of work which should have been passed as O. K.

Cutting speeds and feeds should of course be looked into and it will frequently be found that a stiffer machine with a better feed mechanism will prove a paying investment. The kind of tools being used may also prove a factor in securing increased production. But study the other factors as well, they are frequently sources of leaks which are unsuspected and yet count up to a wasteful total that is amazing.

Wages Should Not Depend on Profits

WE QUOTE from an editorial in the *New York Tribune* of July 20 the following:

"Thomas Kennedy, chairman of the Anthracite Miners Scale Committee, complains that 'It seems that interest lies in only one direction, and that is to put wages on the arbitration table and permit the profits of the operators to go unchallenged.' If things are so, if the strike settlement committee asked for by the president is not to consider profits as well as wages, Chairman Kennedy has just cause to complain."

It is perfectly proper that the question of wages should be looked into. It is also perfectly correct that the question of profits should be looked into. But, we wish to state our conviction most emphatically that the one has nothing to do with the other. If it should be found that the profits are unreasonably high, this would not be a reason why wages should be raised. Nor should wages be lowered because profits are low.

This idea that profits and wages have some relation, one to the other, is so common that it may not be amiss to call attention to the fact that there may be two companies in the same industry, one of which makes large profits while the other one is barely keeping alive. If there were such a relation between wages and profits, as many people seem to think, then the employees of the first company should receive unusually high wages while those of the second company would have to be put on starvation diet.

The worker is entitled to a living wage or to a saving wage and he may be entitled to more than that, but his title to these things is not based on the fact that his employer is making money, but rather on the fact that he is giving his energy and contributes to production. His work is part of the world's work and for that reason alone he is entitled to his reward. The amount of his compensation should be based on the value of his work and to a certain extent on the preparation necessary to bring him to that point where he can perform his work successfully.

If he and his employer are partners, that is if he shares in the losses as well as in the profits, then the amount of profits would be a measure for the amount of his wages, but not until then. Simple as this idea is, it seems to be overlooked by many people many times.

An Achievement in Safe Aviation

THE Air Mail has added another record to its list of creditable achievements, achievements which have no equal in aviation the world over. During the year ending June 30, 1922, the air mail planes flew 1,750,000 miles, or seventy times the distance around the globe, and without a single fatality. This record is all the more remarkable when we consider that much of the flying was over such rugged country as the Rocky and Sierra Madre Mountains, where safe forced landings are almost impossible.

Those who still look at the airplane as a highly dangerous toy will have to revise their ideas, as it is doubtful if any other method of transportation can show a better record. The freedom from accidents speaks volumes for the painstaking work of those in charge of the planes and the service in general. The motors and planes must have been kept in excellent condition and the pilots must have exercised great care to achieve such a result. Every mechanic must have given wholehearted service and worked harmoniously.

This performance is all the more noteworthy when we recall that the appropriation for the service was sadly inadequate and required curtailment in every direction. Congressional doubters as to the practicability of the air mail service should take warning and loosen the purse strings for a service which bears directly on the development of commercial aviation in this country.

The country as a whole is to be congratulated on having a corps of men in the Post Office Department who can accomplish such remarkable results. They deserve the highest commendation and should be rewarded by being allowed to further develop the Air Mail Service along safe and sane lines.

Shop Equipment News

Automatic Multiple Die-Casting Machine

The machine shown in Fig. 1 is a multiple automatic die-casting machine that has been developed by the Automatic Die Casting Co., 1120 Marshall Field Annex, Chicago, Ill. The machine is of rotary type, consisting principally of a table carrying four dies rotating about a central vertical shaft. The four dies can be of the same or different patterns, as the machine works at a given rate of speed and the same amount of time is required for any casting. Two castings are made at the same time, eight castings being delivered at each complete revolution of the table. Any of the metals now used in die casting can be used in the machine.

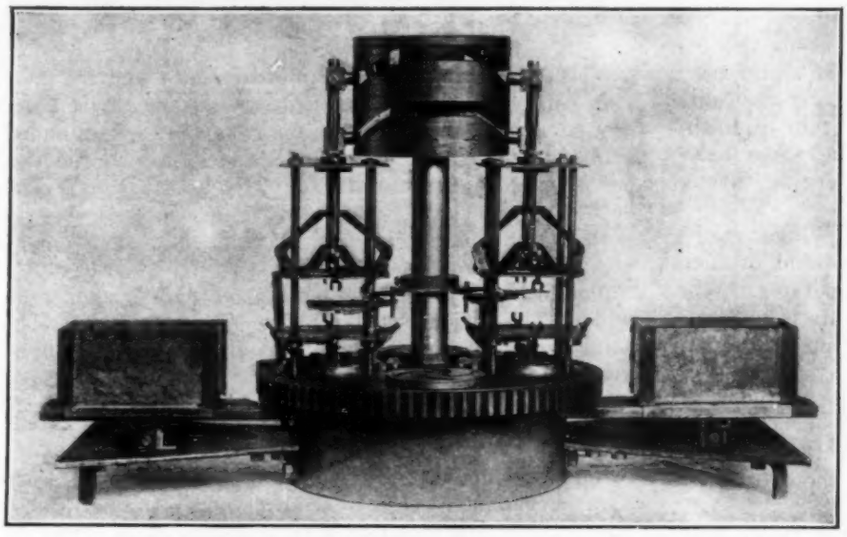


FIG. 1—AUTOMATIC MULTIPLE DIE-CASTING MACHINE

The four dies, which are placed at equi-distant points near the edge of the machine table, are enclosed in die-cages which support the operating mechanism. (Two of the die-cages have been removed from the machine shown in the illustration so that the mechanism may be seen more clearly.) Through the center of each die-cage is a vertical shaft, enclosed in a sleeve made of steel tubing. The shaft is attached to the upper half of the die, and the tubing is attached to the mechanism that controls the core pins.

To the upper end of the shaft is attached a follower that rides in the upper one of the two grooves in the large cam attached to the main shaft. A follower attached to the sleeve rides in the lower groove. As the table revolves, the shaft and sleeve are raised and lowered by the action of the cams, thus opening and closing the die and setting or withdrawing the upper core pins. The cam grooves are so made that the core pins are placed in position just before the dies are closed, and withdrawn just after the dies are opened.

The lower core pins are held by four short levers that ride in four curved slots in a round plate resting on the table of the machine and centrally located between the four posts of the die-cage. The plate is made to turn first in one direction and then in the other as the table revolves, thus causing the core pins to converge and separate as desired.

On opposite sides of the table are located two metal boxes, mounted on the ends of a long arm that passes through the base of the machine. This arm is pivoted in the center, so that it can swing approximately 60 deg. in a horizontal plane. Each box is lined with firebrick and contains a pot for the metal. The pot, a cross-section of which is shown in Fig. 2, resembles a tea kettle with a vertical cylinder in the center in which a piston is operated by a cam on a horizontal shaft. When the piston is raised, the metal flows into the cylinder through a number of small holes; and when the piston is forced downward, the metal is forced into the bottom of the pot, out through the spout and into the die. A second cam operates a lever attached to the top of the piston so as to raise it. The machine is so designed that the piston cannot operate if the spout of the pot is not in the correct position in the die-opening, thus precluding the possibility of danger to the operator.

A series of gas jets inside the box melts the metal and keeps it at the desired temperature while the machine is in operation. As the table revolves to bring two of the dies in line with the two pots, the metal boxes slide toward the table with the spout of the pot entering the gate in the die. The arm swings with the table while the pistons are forcing the metal into the dies, then the boxes are withdrawn and the arm swings back in time for the next set of dies. Directly

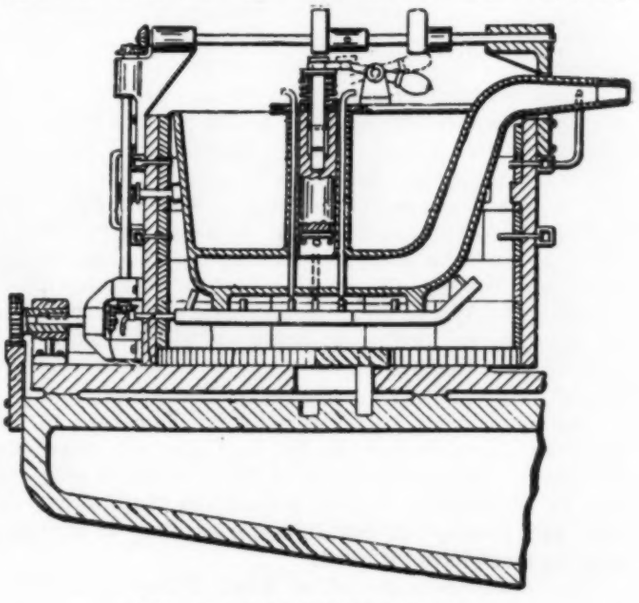


FIG. 2—CROSS-SECTION OF POT

after the two dies have received their charges of metal, they are automatically opened, the core pins are pulled out, the castings are ejected, the dies cleaned and closed, the core pins are pushed in, and the dies are ready for another charge. In the meantime, the other two dies are passing through the same cycle of operations.

As the upper half of the die is raised to the maximum height, carrying the casting with it, a pin knocks the casting loose and causes it to fall onto the plate which can be seen suspended between the upper and lower halves of the dies. The plate is then withdrawn and at the proper time a tripping mechanism causes the plate to turn and dump the casting.

After the castings have been removed from the dies, a rotary brush attached to a rack is fed forward across the face of each die, revolving as it goes and cleaning the die. Then the brushes are returned to their places and a powerful jet of air is blown upon the face of each die for the purpose of removing any particles that may have clung to the die.

A complete water circulation system keeps the dies at the proper temperature at all times, the water being introduced through a swivel overhead pipe at the center of the machine, then passing through four radiating pipes that connect with both the upper and lower halves of each set of dies and eventually discharging through the base of the machine.

The pots can be operated by either the plunger method or compressed air, depending upon the kind of metal being used and the preference of the operator. When the compressed air method is used, the air is preheated so that no further expansion will take place when the air comes in contact with the metal. A system of burners surrounding the cylinder keeps the cylinder and piston at the correct temperature, in order to prevent the piston from sticking in the cylinder and to prevent any metal from adhering to the wall of the cylinder.

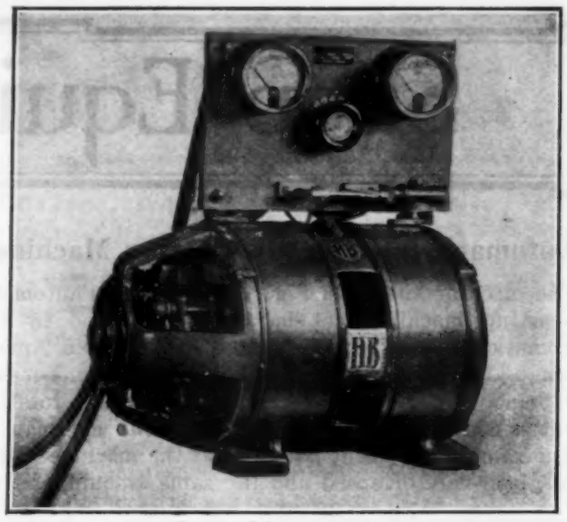
Hobart HB Constant-Potential Battery Charging Outfit

The accompanying illustration shows a storage-battery charging outfit that has recently been placed on the market by the Hobart Brothers Co., Troy, Ohio. The chief feature of the machine is that it charges at constant potential, so that batteries of the type ordinarily employed in electric automobiles can be completely charged in from six to eight hours.

When the batteries are first placed in the circuit, they draw a large amperage. As the charge builds up, the resistance of the battery increases, so that the amperage decreases. When the battery is fully charged, it can be left connected to the line without danger of injury, as no current flows. It is stated that with the constant-potential method of charging, the charge occurs very rapidly, the greater part of it taking place within three hours after connection. Also, since the battery does not heat appreciably and practically no gassing occurs, the life of the battery is said to be prolonged.

Any number of batteries may be connected to the machine, provided that the full load does not exceed the amperage capacity. The short time in which batteries can be charged is said to reduce the cost of current and the number of rental batteries that a charging station must have on hand.

The outfit consists of a 5-hp. ball-bearing motor built in one unit with a 7½-volt, 200-ampere constant-potential generator. Combining the motor and the generator in one unit eliminates trouble that may arise from lack of alignment of two units. The outfit is intended primarily for charging 6-volt batteries, although it can be adapted to use for 12- or 24-volt batteries. The outfit is completely equipped with all necessary parts such as bus bars, terminals, instruments, switchboard and 12 ft. of connecting cable.

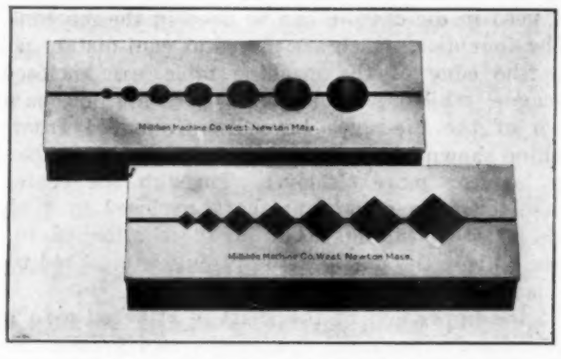


HB CONSTANT-POTENTIAL CHARGING OUTFIT

The machine is 17 in. in height, 33 in. long and 16 in. wide. The switchboard is 12 x 18 in. in size. The total height of the machine and switchboard is 30 in. and the net weight 575 pounds.

Milliken Spring Vise Jaw Clamps

The accompanying illustration shows the vise jaw clamps that have recently been placed on the market by the Milliken Machine Co., West Newton, Mass. The devices are intended for use in a bench vise or in vise jaws or clamps mounted on milling machines, surface grinding machines and similar tools. Each pair has different sizes of holes, for either square or round stock, so that rods, pins or screws can be securely gripped. Either rough or finished stock can thus be held without marring or bruising it when performing machining operations such as slotting, milling, grinding or threading.



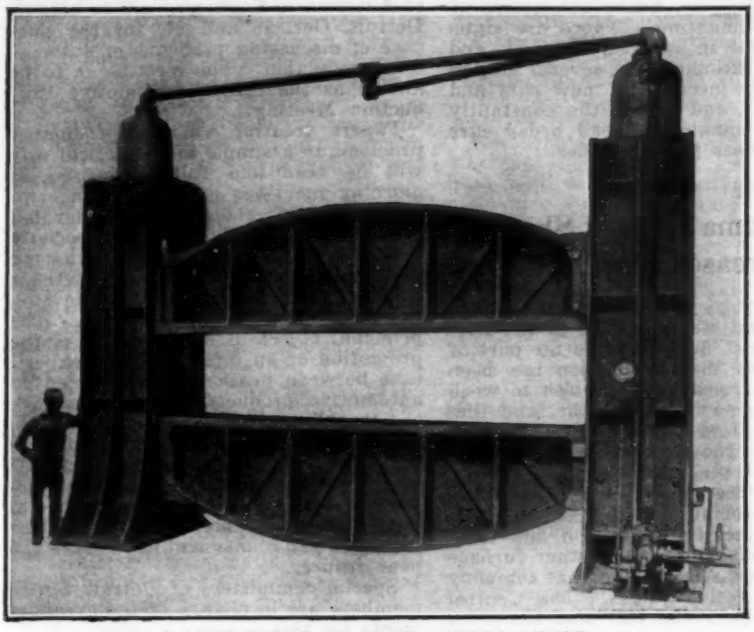
MILLIKEN SPRING VISE JAW CLAMPS

When the jaws of the vise are released, two springs cause the jaws of the clamp to automatically open, so that the work is released. The clamps are hardened and finished all over. They are made to take stock from ¼ to ½ in. in size.

Large Hydraulic Flanging Press

A very large hydraulic flanging press has recently been built by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, for the Merchants Dispatch Transportation Co., Rochester, N. Y. The machine, which is shown in the accompanying illustration, is used for flanging the plates for Murphy car ends. Its principal feature is its size, as it will flange cold steel $\frac{7}{16}$ in. thick by 10 ft. long.

The press is equipped with two 20-in. diameter rams.



LARGE HYDRAULIC FLANGING PRESS

Two auxiliary cylinders 5½ in. in diameter are used for returning the platen to the upper position. The stroke is 24 in. and the maximum distance between the platens is 36 in. The press is capable of exerting a pressure of 435 tons. The strength required to withstand this pressure is obtained by the use of cast steel for all cylinders, platens and housings. The total weight of the machine is 42 tons.

Valves and fittings made by the Hydraulic Press Manufacturing Co. are used in connecting the press to the hydraulic line. A three-way, poppet-type, high-pressure valve is used to control all the movements of the press by the manipulation of one hand lever.

Marvin & Casler Castellating and Hexing Machine

On page 36 of *American Machinist* there appeared a description of a nut castellating and hexing machine that has recently been placed on the market by the Manufacturers' Consulting Engineers, Syracuse, N. Y. The Marvin & Casler Co., Canastota, N. Y., has just taken over the manufacture and sale of this machine.

The machine is intended especially for the castellation of nuts and for milling the hex form on spark plugs or such articles. The work is held in six collets carried on a revolving turret, the pieces in every alternate collet being operated on simultaneously. The turret is automatically oscillated to and from the cutters. The operation of the machine is continuous, six pieces being completed at each revolution of the turret. The capacity is 1,000 nuts per hour.

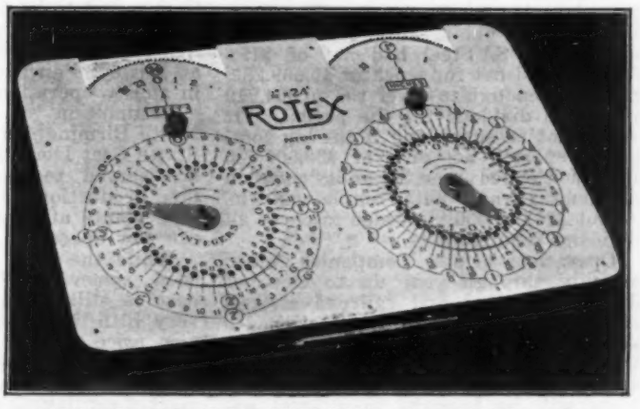
Leinert "Rotex" Dimension Calculator

A device to enable the rapid mechanical addition and subtraction of fractions of an inch, inches and feet, has recently been placed on the market by W. Leinert, 410 West 23rd St., New York, N. Y. This device is shown in the accompanying illustration and is designated as the "Rotex" rapid calculator. It consists of a front plate carrying two circular scales, one divided into forty-eight equal parts and the other into sixty-four parts. The former scale is used for operations involving integers of feet and inches, and the latter scale for those involving fractions of an inch. The divisions of the scale are indicated with black figures in clockwise sequence for addition, and red figures in counter-clockwise sequence for subtraction.

Mounted within each of these scales is a circular rotatable disk graduated at its periphery with divisions and figures corresponding to those on the scale. A pinion on the shaft of each disk meshes with a gear carrying the circular scale at the top of the device. The perforations on the rotatable disks provide for the insertion of a stylus that is furnished with the device. The celluloid pointers serve to indicate the last item in case of interruption.

When starting to use the device, the dials are set to zero by first disengaging the gears, turning the dials, and then bringing the gears into engagement. The disks are turned consecutively to the different values that it is desired to add or subtract, the motion being clockwise using the black figures when adding, and counter-clockwise using the red figures when subtracting. The calculations are always started with the zero mark of the disk placed opposite that of the scale, and the zero on the disk is moved either way necessary for the operation. A buzzer signals at each complete revolution of the upper gear showing feet.

When reading the results, the number of feet is indicated on the upper gear on the left-hand side, and the integers of inches on the lower disk on the left-hand



LEINERT "ROTEX" DIMENSION CALCULATOR FOR ADDITION AND SUBTRACTION

side and on the upper gear on the right-hand side, while the fractions of inches are read on the lower disk at the right. The device should prove of especial use when adding and checking a series of dimensions on a drawing to obtain the overall dimensions, although it can be adapted to many other uses of a similar nature.

News Section

Auto Production Makes New Record

According to reports just issued by the National Automobile Chamber of Commerce, the June production of motor vehicles was slightly in excess of 288,000 cars, including both passenger vehicles and trucks. This establishes a new high record for motor car production in the American industry. It is 12 per cent. higher than the May production figures, which were 256,000, and indicates a total production for 1922 of more than 2,000,000 motor vehicles. For the second quarter of the year, 763,000 motor cars were manufactured, and the total for the first six months was 1,137,000. This compares with a production of 1,668,000 for 1921 and the record production in 1920 of 2,205,197.

Steel Companies Show Increased Earnings

According to Dow, Jones & Co., an improvement in steel demand, together with ascending prices for steel products, is reflected in earnings statements of steel companies to hand thus far. Republic Iron & Steel for the first time since the beginning of 1921, showed a profit for stock. Lackawanna, while reporting a deficit for the second quarter, did much better than in the first; Gulf States Steel's second quarter profits were equal to $1.70 a share on common stock against 40 cents in January-March period. Vanadium, which although not a steel company proper depends for its business on the steel trade, showed a small balance for stock in the half year due to profitable business in second quarter offsetting loss in first.

A similar improvement may be expected in United States Steel's report, to be made public July 25. In first quarter U. S. Steel had net of $19,339,985, and net for stock of $5,909,232, not quite enough to cover the $6,304,919 preferred dividend for the period. It would not be surprising if the big company reported net of over $30,000,000 in period ended June 30, or its common dividend earned with ample margin. About $26,000,000 is needed to cover all dividend requirements.

Operations of steel companies gained steadily through year up to close of June. The coal and railroad strikes, combined, have affected operations to some extent in July, but there is every indication that as soon as these troublesome factors are out of the way operations will be brought to a level approximating demand.

U. S. Steel began the year with operations around 40 per cent capacity. At close of first quarter they were close to 70 per cent. Between April and June they ranged from 71 per cent to 78 per cent capacity. Broadly speaking, a similar gain in operations was shown.

Prospects for the remainder of the year in steel trade are good. Pending the settlement of the labor controversies, consumers are more concerned about deliveries than about placing forward business, but demand is still satisfactory. Canners and automobile makers have been heavy consumers of steel for some time. There are signs of a revival in railroad demand, and steel men estimate that several million tons will be needed for new cars and locomotives, and to put the constantly increasing number of bad order cars into first class running order.

Alabama District Shows Increased Production

A survey of industrial conditions in the iron and steel business of the Alabama district during the latter part of July, shows that production has been steadily increasing from week to week during the past two months, and that there is promise of steady activity throughout the district during the remainder of the year, according to the Atlanta office of the Southern Metal Trades Association.

The Tennessee Coal, Iron and Railroad Co. has blown in another furnace at Bessemer, Ala., giving that company now nine active stacks. The Central Iron and Coal Co. has also blown in another furnace and that company now has all of its stacks going. The Republic Iron Co. is expected to start up another stack in the near future. The present total of active stacks in Alabama is twenty-two as compared with five at this time in 1921, not including the stacks referred to above.

The concrete bar mill of the Southern Steel and Rolling Mills Co., known as the Gerson Rolling Mills, has begun operations, while the larger 16-inch bar mill being constructed by this company is expected to be finished and ready to start up within the next thirty days. Nearly all departments of the steel mills at Ensley, Fairfield and Bessemer are in steady operation.

Resumption of operations at the North Birmingham plant of the United States Cast Iron Pipe and Foundry Co., has served to increase the district's pipe production. Practically all of the pipe plants at Bessemer and Anniston are now operating at capacity.

While the iron market of late has been somewhat listless Birmingham base is still at $18.50 to $20, though very little business is reported at the new price as yet. Pressure base pipe is at $37 and $38, with sanitary base at $55, $60 and $65, the cast-iron pipe market continuing strong.

Official figures on pig-iron production in Alabama during June show an increase of more than 100 per cent over June of 1921. Production is officially given at 189,101 tons as compared with 93,000 tons in June, 1921. The output during July is expected to exceed that of June as there have been four additional furnaces started up since the first of the month.

S. A. E. Production Men to Meet in Detroit

A national meeting of the Society of Automotive Engineers will be held in Detroit, Oct. 26 and 27, for the purpose of discussing problems of automotive production. The meeting is to be known as the S.A.E. Automotive Production Meeting.

Papers treating current production problems in a simple and practical way will be read and fully discussed in morning meetings on each of the two days. The afternoons will be devoted to factory inspection, trips especially arranged for the purpose of viewing new and advanced production methods that will particularly interest the tool, inspection and production men. The principal object of this meeting is the promotion of an interchange of experience between practical factory men on automotive production problems which are troubling them in their daily work.

An S.A.E. Production dinner will be held Thursday evening, Oct. 26, where social friendships between production men will be promoted. Announcement of the locations of the meetings and dinner will be made in the near future.

Special committees of Detroit S.A.E. members are in charge of the arrangements for this national meeting. K. L. Herrmann, a Studebaker production engineer, is chairman of the committee which is selecting the papers and topics for discussion. Suggestions or requests to present papers should be addressed to the S.A.E. New York office.

Engineers of Steel Industry Will Hold Convention

The engineers in the iron and steel industry will meet in convention during the week of September 11th to 15th, 1922, at Cleveland Public Hall, Cleveland, Ohio, at which time there will be presented and discussed subjects dealing particularly with steel mill problems.

The papers have been written with a view of giving to the engineers as much practical data as is possible, feeling that this class of information is far more beneficial than the theoretical side when dealing with steel mill problems.

Some of those who will present and discuss the subjects are Dr. C. P. Steinmetz, Messrs. B. G. Lamme, Wilfred Sykes, A. G. Witting, F. C. Watson, D. M. Petty, L. W. Heller, R. B. Gerhardt, D. B. Rushmore, J. B. Crane, E. R. Fish, R. M. Rush, R. E. Butler, F. Hodson, Prof. Edgar Kidwell, F. W. Cramer, A. R. Leavitt, E. T. Moore, R. H. Bauer, F. A. Wiley, L. F. Galbraith, R. S. Shoemaker.

Representatives from practically every steel mill in the United States are expected at this convention for it will interest practically every class of engineer.

Railroad Shopmen Better Paid Than in Private Industry

A comparison of the wages of railroad shopmen with the wages paid to employees in foundries and machine shops in other industries, given out today by the National Industrial Conference Board, 10 East 39th Street, New York City, shows that the average hourly earnings of the railroad employees stand at least 25 per cent and weekly earnings at least 32 per cent above those paid to men performing practically identical work in privately controlled plants. Railroad skilled shop mechanics include machinists, boiler makers, blacksmiths, sheet metal workers, and electrical workers, whose duties in the railroad shops are practically identical with the duties of men employed in commercial foundries and machine shops.

The National Industrial Conference Board has just completed a survey of the wages of employees of foundry and machine shops other than railroad, which shows that the average earnings of skilled labor stood at 56.1 cents on January 1, 1922. In a statement given out by the Conference Board on July 2, the average hourly earnings of railroad skilled shop labor were shown to be 70.1 cents under the new wage rates, this being based on the hourly rate of 70 cents laid down by the U. S. Railroad Labor Board, and a working week of 48.06 hours.

Wages Are Higher

The hourly wages of skilled mechanics employed by the railroads are therefore 25 per cent higher than those paid skilled mechanical employees of other industries in the country at the first of the year. Wage rates in private industry, moreover, have declined in the past six months, so that the comparative position of railroad shopmen and other shop workers in private industry is probably at present more marked than here shown. The National Industrial Conference Board's report covers the wages of 388,560 men employed in 1,338 plants, or 73 per cent of all the wage earners in foundries and machine shops as shown by the United States Census of Manufactures in 1919, and can therefore be regarded as thoroughly representative of the conditions existing in foundries and machine shops throughout the country.

Studies by the Conference Board show that the average hourly earnings of skilled shop labor in privately controlled plants rose from 30.4 cents per hour in 1914 to 71.3 cents in September, 1920. On January 1 of the present year, these wages had declined to 56.1 cents per hour. The railroad shopmen's wages rose during the war period from 29.8 cents per hour in 1914 to 86.4 cents per hour at the peak in November, 1920, and despite two wage cuts ordered by the Railroad Labor Board, the wages of the striking shopmen have been reduced to a point which is only 1.2 cents per hour below the rates paid to shopmen in other industries at the peak of the industrial inflation.

A comparison of the weekly wages of the two classes of employees shows a situation which is even more favorable to the railroad shopmen than in the case of hourly earnings. This aspect of the matter is important, as weekly earnings constitute a much better basis for judging the comparative status of the two groups of workers than do hourly earnings. The statement of the National Industrial Conference Board referred to above, estimated the average weekly earnings of skilled railroad mechanics to be $33.67 under the reduced rates recently established by the Railroad Labor Board. The weekly wages of foundry and machine shop employees, however, on Jan. 1, 1922, were $25.08, giving the railroad employees a clear advantage of 32 per cent in weekly earnings over the earnings of men performing work identical with their own, but in the shops of privately controlled companies. Since a decline in wages of outside shop workers has taken place since the first of the year, the position of the railroad shopmen is even more favorable.

The employees of the foundry and machine shop industry are shown to have been working an average of 44.7 hours per week on January 1, while it is estimated that on the basis of the average number of hours worked per week since September, 1919, the railroad shopmen will average 48.06 hours. Statements have recently appeared which purport to show that any comparison of the estimated earnings of railroad employees for 1922 with the actual earnings of 1914 are unfavorable to the employees because of the fewer hours of work performed in 1914 on account of the severe industrial depression of that year. The figures published by the Interstate Commerce Commission, however, show that in 1914 the average number of hours of work per week for railroad shopmen was 51.4 or nearly 3 hours per week more than the estimate of 48.06 hours for 1922.

In 1914, moreover, the average working day of railroad shopmen was nominally ten hours but fell to the lower figure by reason of lack of business. Since that time the nominal week has been reduced by the insistence of the unions to 48 hours or 8 hours per day, with a 6-day week, and the attempt is now being made to use this fact to make the real earnings of railroad employees appear to be less than in 1914.

The result is, therefore, that railroad shopmen are in a more advantageous position than they were in 1914, in three ways: First, that their hours of employment have been reduced, giving them more time for leisure and recreation; second, that their economic status, even under the new wage cuts, is 10 per cent higher than eight years ago; and third, that the average weekly wages of railroad shopmen are at least 32 per cent higher than those of men doing the same work but employed by other industries, where wages are regulated as a general rule, by the supply and demand for labor.

"Made-in-Atlanta" Exhibition

Several hundred Atlanta manufacturers will co-operate in a "Made-in-Atlanta" exhibition to be held at the Atlanta Auditorium Sept. 18 to 23, at which time the products of all Atlanta factories will be on display. Among the foundries and machine shops already listed is the Atlanta Stove Works, Hanson Motor Co., Atlantic Steel Co., Butters-Camp Co., Nick Heater Corporation.

Gerard Swope Elected a Fellow of the A. I. E. E.

Gerard Swope, president of the General Electric Company, has just been elected a Fellow of the American Institute of Electrical Engineers. Fellowship is the highest grade of membership as is characterized by the stipulation that the president of the Institute is to be chosen only from among the Fellows.

Mr. Swope, although an electrical engineer by training, has developed into a conspicuous business executive as well, one whose career has revealed an ability for continual accomplishment. He was graduated in 1895 from the Massachusetts Institute of Technology as an electrical engineer, and after his graduation found work in the shops of the Western Electric Company, forging ahead rapidly until he became general manager of power apparatus business, making that department extremely successful.

In 1908, he became general sales manager of the Western Electric Company and in 1913 was made a vice-president and director, in charge of all commercial work in the United States and of all manufacturing, engineering and commercial work outside of this country. This necessitated traveling abroad, and while in Japan he was decorated by the Emperor with the Order of the Rising Sun.

During the period of America's participation in the war, Mr. Swope served as assistant director of purchase, storage and traffic, receiving the Distinguished Service Medal. He was made a Chevalier of the Legion of Honor by the French government.

In 1919 he was made president of the International General Electric Company, serving in that position until chosen president of the General Electric Company last spring.

Gasoline Consumption Shows Big Increase

Of particular interest to consumers of gasoline, kerosene and fuel oil whether for automobile or any other purpose, is the recent announcement from the Bureau of Mines.

Due chiefly to the record breaking output of automobiles, the gasoline stocks, which have been mounting steadily to new high records, are now on the decline. On June 1, stocks on hand at the refineries amounted to 856,607,102 gallons, which is 35,661,000 gallons below the record figure of 892,267,766 gallons atained at the beginning of May. The fact that the billion-gallon mark, forecasted in some quarters, was not reached seems due to the tremendous increase in domestic consumption of gasoline, which amounted to 499,242,343 gallons in May. This figure represents an increase in domestic consumption of gasoline of 113,000,000 gallons over the month of April and 145,000,000 gallons over the month of May, 1921. Gasoline consumption figures for May constitute a record for that month, and are within four million gallons of the record-setting figure attained in August, 1921, although occurring three months before the customary month of largest consumption.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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PRESIDENT HARDING is trying valiantly to hold the shield of governmental protection impartially over the Constitutional rights of the strikers and their employers as well as to protect those who may be willing to do the work that the strikers have abandoned.

As usual in such cases each of the parties in interest feels that favoritism is being shown to the others, but the vast majority of the public recognize the fairness of the President's attitude. Some, it is true, advocate measures that would be more coercive or Rooseveltian, but it is plain that most people are satisfied with Mr. Harding's punctilious respect for the Constitution and believe that his policy will be successful. It is only upon this theory that the tranquility of the markets can be explained for it must be admitted that the winter will be one of genuine discontent and distress unless the strikes are soon settled.

Money in Demand

The non-union production of bituminous coal is disappointing and far below current requirements. Little or no anthracite is being mined and while the railroads bravely claim that they are functioning normally it is undeniably true that many are seriously handicapped and that we may have a vexatious freight blockade in the autumn unless relief is soon found. This will not only delay the distribution of goods but tie up the capital invested in them.

The result may be an increased demand for money as it is estimated that merchandise worth at least a billion dollars is normally in the hands of the railroad companies and any delay in its delivery would of course retard the liquidation of commercial credits.

There is already some indication of this, for according to the reports of 795 of the more important banks, commercial loans are now increasing for the first time in more than a year. The increase for the two weeks ending July 19 was $25,000,000, but as the total is still $1,276,000,000 below the figures of May 25, 1921, and the weekly statement of the Federal Reserve System shows a reserve ratio of 79.2 per cent there is abundant room for further expansion.

This high reserve ratio, which compares with 77.8 at the end of the previous week, is in part due to an increase of nearly $10,000,000 in the gold held and in part to a decrease in deposits and earning assets, which suggests that a reduction in the rediscount rate will soon be necessary if the Federal Reserve Banks are to keep their resources remuneratively employed.

Taking advantage of the plethora of bank credit Secretary Mellon has announced that one billion of the 4¾ per cent Victory notes will be called for payment on December 15 and that of the obligations so called $300,000,000 will be exchangeable on August 1 for an equal amount of four year Treasury certificates bearing interest at 4¼ per cent. As on the present money market these Treasury certificates are worth a premium, the effect has been to advance the Victory notes called and to pave the way for successfully refunding the 4¼ billions of short dated debt that matures during the fiscal year ending June 30, 1923. All of which serves to emphasize afresh the ease of money due to the continued gain in our gold supply and the possibility of inflation as a consequence.

The resiliency of the security markets in the face of the strikes is perhaps due to a subconscious recognition of this possibility. Under the leadership of the Government issues most domestic bonds have been in good demand at advancing prices and while stocks have been from time to time attacked by the bears they have rallied sharply upon the slightest intimation of good news. On these rallies the railroad shares have been the leaders and a boom in railroad stocks is quite possible when the labor troubles are ended. Eliminating the coal traffic the car loadings indicate that the railroads are now handling a record tonnage of other freight.

Of the commodity markets there is nothing novel or sensational to report. Raw cotton has been rather easier on a generally admitted improvement in the crop. During the critical month of August deterioration is normal and it will be strange if the month passes without a crop scare and a sharp advance in the market. But in the long run an increase in European consumption must be relied upon to sustain prices and it is to be expected if the arrangements for the rehabilitation of German credit now under discussion are consummated.

Activity in All Industries

Our domestic trade in cotton goods and nearly everything else is satisfactory and will be better when the strikes are settled. A broad speculation in sugar is developing but the market hesitates a little as Cuban raws approach four cents. Once that rubicon is passed the upward progress will probably be more rapid for it is becoming plain that there will be active competition for the small remnant of the much exploited surplus that remains.

The demand for hides and leather is also better and shoe manufacturers report an active trade. The market for wool and woolen goods is somewhat disarranged by the quarrel over the wool schedule of the tariff bill but the minor textiles, silk, linen, jute and burlaps are all tending upward. The petroleum production is now the largest on record. The increase is perhaps due to the coal shortage.

Pig iron is a dollar higher in anticipation of the activity that is expected when the steel mills can get the coal that they require. Tin and zinc have also advanced. Copper still hangs around 13¾ to 14 cents. It must be a price that pays producers for the supply seems equal to the demand, which is large because of the boom in building and construction activity generally. In greater New York alone the new buildings now under way will house 38,363 families and in New York and New Jersey some $256,528,000 was invested in new residences during the six months ending June 30, last.

The automobile production for June was the largest on record for that month and there has been a correspondingly large demand for tires. As a result America now uses 65 per cent of all the world's rubber production and as new tires are required and new uses for rubber are found an advance in that article may come even though the English and the Dutch do not agree to reduce production. Coffee is dull and dragging. The market is paralyzed by the fear that the Brazilian Government is quietly selling its valorized holdings.

The news from abroad is not sensational or important. The London stock market is firm on easy money and coal is higher in England on American purchases totaling over 700,000 tons. Many close observers believe that the British Government is sending gold here at the rate of ten million dollars a week with the purpose of raising the reserve ratio of our Reserve banks to a point that will insure an acceptance of our quota of the inevitable German loan. I continue to believe that when and if it is issued the German mark will be worth more than 20 cents a hundred.

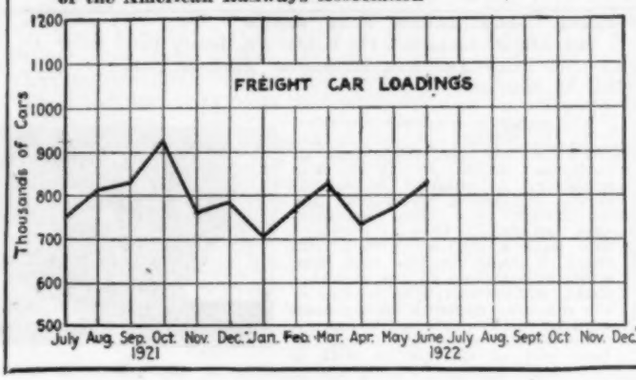
Apart from the coal and railway strikes which must be settled and may be settled when this is printed the low price of wheat is the only adverse factor of importance in the commercial complex of this country.

That it is not more generally complained of is surprising and it may be that I overestimate its seriousness. If so I shall be glad for, if the purchasing power of the farmer is not impaired, this fall will be a period of great prosperity despite the probability of high priced coal.

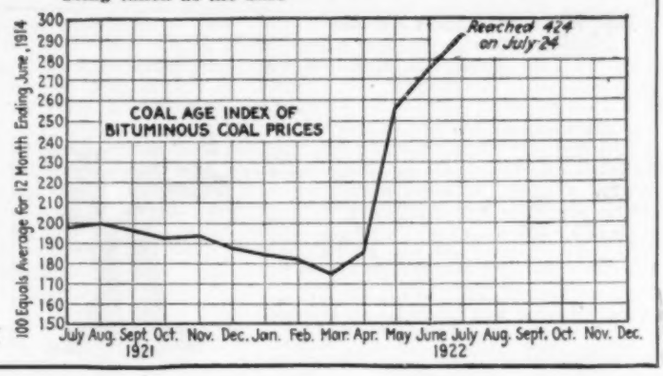
Southern Pig Iron Output Shows Increase

Pig iron production continues to pick up in the Alabama district, with inquiries and sales getting steadily better. Prices prevailing are $19 and $20 per ton base for No. 2 foundry iron. During June a total of four furnaces were blown in, and production for the month was 189,008 tons, bringing the six-month total to 945,117 tons, as compared with 630,343 tons the first six months of 1921. Since March production each month has increased steadily by several thousand tons, and the outlook gives promise of close to normalcy before the end of the year.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base



AMERICAN foreign trade has just closed its fiscal year. For the twelve months ending June 30, 1922, exports show a total value of $3,770,220,971. Imports in the corresponding period were valued at $2,607,618,110. By way of comparison the fiscal year ending June 30, 1920, showed exports having a total value of $6,516,510,033 and imports having a total valued at $3,654,459,346. In other words, the so-called "favorable" trade balance of the United States, that is, the excess of exports over imports standing at nearly 3 billions of dollars on June 20, 1921, has declined until on June 30th of this year it is just a little over one billion dollars. While the position of the United States is shifting slowly toward an excess of imports over exports, it does not appear that this point will be reached in the very near future.

The country's excess of exports has declined to an average only slightly higher than pre-war levels, yet it is still being maintained by the new loans and investments abroad.

"It is worthy of note that although the total value of foreign trade is still more than 60 per cent above the pre-war total," says a local bank, "the current average monthly net balance of exports is only moderately above the prewar level.

"This substantial reduction in the excess of exports does not, however, indicate that an excess of imports is a probable development of the near future. The expectation of a net balance of imports is based on the fact that eventually the obligations of other countries to the United States can be liquidated only by payments in goods and services. But as regards the largest item in this indebtedness—the advances made by the Government to the Allies—interest payments have thus far been deferred and consequently have exercised no influence on the trade balance. Moreover, general negotiations regarding funding and interest payments on the Allied indebtedness have hardly more than begun, so that for some months at least the influence of this factor on the trade balance will be slight.

Comparative Prices of Shop Supplies

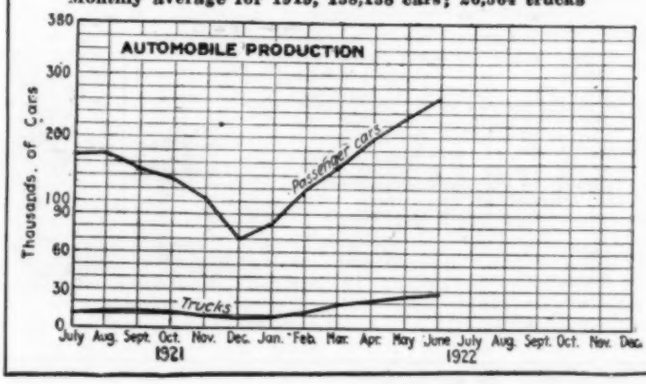
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.027	$0.0252	$0.0283
Cold finished shafting	per lb.	0.0335	0.0335	0.0435
Brass rods	per lb.	0.162	0.1550	0.159
Solder (½ and ½)	per lb.	0.21	0.213	0.203
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (¼ in.)	per 100 lb.	3.83	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	.....
Lard cutting oil	per gal.	0.575	0.575	.....
Machine oil	per gal.	0.36	0.36	.....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

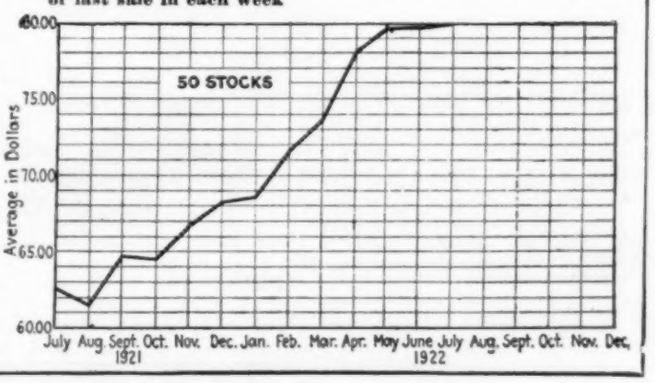
Freight cars loaded with revenue freight during the week ending July 15th totaled 860,907, an increase over the week previous of 142,588 cars. As compared with the corresponding period in 1921, an increase of 86,023 cars is shown. Idle cars on July 8 totaled 405,120 as compared with 405,180 on July 1. Of this total 239,160 were surplus freight cars in good repair in excess of current freight requirements, while the remaining 165,960 were freight cars in bad order in excess of the normal number unfit for service.

The Steel Corporation's report for the second quarter which shows a gain of more than $7,000,000 over the first three months, created an optimistic feeling. The net earnings for the second quarter amounted to $27,286,945 as compared with a net of $19,339,983 in the first three months of the current year and $21,892,026 in the second quarter.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Monthly average for 1919, 138,138 cars; 26,364 trucks



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week



Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

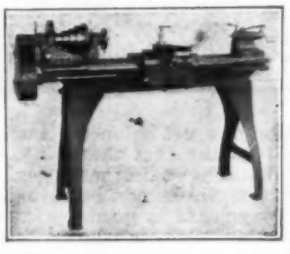
Saw, Bench, Portable, Universal
Union Machine Co., Grand Rapids, Mich.
"American Machinist," April 13, 1922

The machine, adapted to use in pattern and woodworking shops for cutting stock up to 2 in. in thickness, can be mounted on a bench or furnished with a base. A ½-hp. motor drives the 7-in. saw, and is controlled by a switch at the front. The table can be tilted to any angle up to 45 deg. and locked in place, and has graduations for setting. The saw may be furnished for either ripping, cross cutting, or combination work. The arbor of the saw runs in ball bearings at a speed of 5,000 r.p.m. Table, 20 x 18 in. Bench style: height, 10 in.; weight, 170 lb. Mounted on base: height, 36 in.; weight, 330 pounds.

Saw, Bench, Universal
State Pattern & Machine Co., 2824 West Lake St., Chicago, Ill.
"American Machinist," April 13, 1922

The saw is used in pattern, cabinet and carpenter shops, in shipping rooms and foundries, for cutting wood, carbon, asbestos, fiber and even soft metal. The machine can be supplied with either a tilting or stationary table. The motor is of ½ hp., 110 or 220-volt, and for either a.c. or d.c. The saw can be raised or lowered, and provides a maximum depth of cut of 2¼ in. The speed is 3,500 r.p.m. A guide is furnished to be used on either side of the saw. Height, 34 in. Diameter of the saw, 8 inches.

Lathes, Screw Cutting and Turning, "Handy," 9- to 13-in.
Seneca Falls Manufacturing Co., Inc., Senaca Falls, N. Y.
"American Machinist," April 20, 1922

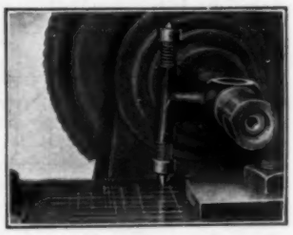


The screw-cutting lathe can be arranged for either motor or belt drive. It has a large hollow spindle, power-driven longitudinal and cross feeds, graduated crossfeed screw, and a set-over tailstock. A plain or compound rest, and a double friction countershaft having a cone belt shifter can be furnished. The plain turning lathe has a 10½-in. swing and 3-ft. bed, and a maximum space of 12 in. between centers. It is equipped with a plain rest, feeds from 0.002 to 0.040 in. per revolution of the spindle, set-over tailstock, three step cone and self-oiling spindle.

Truck, Platform, Hand, Non-Elevating, Heavy-Duty
Plimpton Truck Co., Elm Court, Stamford, Conn.
"American Machinist," April 20, 1922

The truck is used especially in foundries and machine shops where heavy, compact loads are handled. It has a wide wheel base and steering knuckles of the automobile type. The handle is normally held in a vertical position by a spring-loaded plunger. The truck may be furnished to steer on either two or four wheels. It is made with load capacities of 2,000, 3,500 or 5,000 lb. It can be equipped with wide flanged wheels, which can be used either on rails or directly on the pavement.

Punch, Center-Locating, Prick, Scriber
Bernard F. Johnson, 3476 Boulevard, Jersey City, N. J.
"American Machinist," April 13, 1922

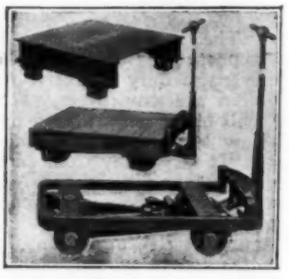


The punch is used for precision work in laying out centers for holes in jigs and dies, and in outlining cams. As it is not necessary to employ buttons in laying out holes, holes can thus be placed very close together. The tool can be used in conjunction with a shaper, milling machine or other machine tool. The work is attached to the machine table, and is moved by means of the machine controls. After each adjustment, a prick mark can be made on the work by tapping the rear end of the punch with a hammer. Springs permit the motion of the punch in either direction.

Filing Machines, Die, Enclosed, Nos. 3 and 4
W. D. Rearwin, 716 Monroe Ave., Grand Rapids, Mich.
"American Machinist," April 20, 1922

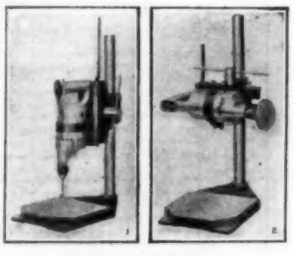
Although smaller in size, the machines are similar in principle to the No. 6 model, and can be mounted on a bench or on short columns. The No. 4 machine has a maximum stroke of 3 in. and a 12-in. square table, arranged to tilt to all four sides, with a swiveling mechanism graduated to 7 deg. on each side. An adjustable hold-down clamp moves with the table. The position of the file slide and the length of stroke are adjustable. Speeds of 200, 300 and 400 r.p.m. are provided. The No. 3 machine is smaller and has a 1½-in. stroke and an 8-in. square table.

Truck, Elevating, Industrial, Hand, Model-E
Plimpton Truck Co., Elm Court, Stamford, Conn.
"American Machinist," April 20, 1922



The front end-plate of the truck is a combined step and thrust bracket, against which the operator may press the handle to force the truck backward. The platform is released by pressing a pedal. The handle is automatically retained in the vertical position when not in use. Steel or wooden platforms can be employed. The steel platforms can be furnished for any truck length in standard widths of 24, 30, 36, 42 and 48 in. The truck is made in capacities of 3,000 and 4,000 lb., with platform sizes of 7 x 18 x 36 to 9 x 20 x 52 inches.

Stand, Drill, Portable, "Hole Shooter"
A. H. Petersen Manufacturing Co., Milwaukee, Wis.
"American Machinist," April 20, 1922



The stand is used with the "Hole Shooter" electric drill. With the drill vertical, the combination serves as a bench drill and, with the motor swung to the horizontal position, it can be used as an electric grinding machine, or for buffing or polishing. The spindle of the machine can be set to operate at any angle. The range of travel of the slide is 12 in., and the range of travel of the rack in any one position is 3½ in. Base, 8 x 8 in. Weight, 30 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

Washington Notes

By Paul Wooton

Service orders extending drastic priority privileges in the transportation of coal were issued by the Interstate Commerce Commission on July 25. Under one of the orders the railroads are given authority to move coal by the most available route. Under another, the railroads are instructed to move coal, coke and fuel oil in preference to all other freight, excepting food for human consumption, food for livestock, livestock and perishable products.

Cars for coal loading are to be furnished first for fuel intended for railroads and for the bunkering of ships; next for public utilities which directly serve the general public under a franchise. This includes street and interurban railways, electric power, light, gas, water and sewer works and ice plants. Hospitals come next in the priority list. Other consumers then are listed in the following order: federal state, county and municipal governments. The order points out that the intention is that all common carriers, public utilities, quasi-public utilities and governments may be kept supplied with coal for current use, "but not for storage, exchange or sale."

Priority also is given to coal for shipment to the Northwest by way of the Lakes and to the commercial sizes of coal for domestic use. The order provides also that no coal is to be subject to reconsignment or diversion, except for some purpose in the same class or in a superior class. Mines producing coal are to be given first call on cars suitable for transportation of their output. The President has submitted a plan to the operators and mineworkers providing for a minimum wage for 280 days each year. The plan has as its object the elimination of those mines not in a position to furnish 280 days' work and thereby meet the evil of overdevelopment in the industry.

The use of machinery in the manufacture of knit fabrics was discussed in the Senate during the tariff debate on July 21. A duty of 60 per cent advalorem, was adopted on knit fabric in the piece, composed wholly or in chief value of cotton or other vegetable fiber, made on a warp knitting machine. A duty of 35 per cent was placed on such articles made on other than a warp knitting machine. A duty of 50 per cent advalorem was placed on gloves of cotton or other vegetable fiber made of fabric knit on a warp knitting machine and 25 per cent on those made on other than a warp knitting machine.

The Union Electric Welding Co., has requested the Supreme Court to review the decision of the Circuit Court of Appeals for the 6th Circuit which decided in favor of J. P. Curry and C. L. Miller in a patent infringement case. Curry and Miller brought the suit originally in the Northern District of Ohio Court, seeking an injunction and an accounting from the welding company for an alleged infringement of patent. The lower courts held that the patent was infringed and awarded Curry and Miller $45,000, representing profits on the infringement. The welding Company has asked the court to set aside the verdict of the lower court. The case will not be considered by the court, however, until it reconvenes in October.

Large Special Broaching Machine Installed

The J. N. LaPointe Co., New London, Conn., has recently shipped to the Schenectady Works of the General Electric Co., an extra large broaching machine of their No. 5 type, which is to be directly driven by a reversing motor.

The machine is designed to cut twelve 0.375 in. slots simultaneously in a stator frame. The jig or fixture attached to the machine for holding and centering the stator frame weighs 1,800 pounds. The weight of the complete machine is 1,200 pounds. The twelve cutter bars are each 1⅞ in. in section by 156 in. long.

Penn State College Will Enlarge Engineering School

In a report made during the past week by the industrial conference committee of engineers making a study of the School of Engineering of the Pennsylvania State College, it is recommended that the Pennsylvania legislature provide for the next biennium new buildings, equipment, and salary increases totalling nearly $2,000,000. The committee endorsed the work being done by the school and stated that of its 2,500 graduates in engineering, over half are in Pennsylvania occupying positions of service to the railways, industries, cities, and the various departments of the State.

The committee making the report was composed of M. I. Kast, architect; Elbert A. Gibbs, chief engineer of the McClintock-Marshall Company; C. B. Keiser, superintendent of motive power of the Pennsylvania Railroad; Carl W. Davis, of the J. H. McFarland Company; C. S. Coler, manager of the educational department of the Westinghouse Electric and Manufacturing Company; and P. C. Haldeman, master mechanic of the Luckens Iron and Steel Company.

Among the new buildings recommended by the committee were a main engineering building to replace one destroyed by fire in 1918, a building for the Department of Electrical Engineering; and a new foundry and transportation building.

To provide for the accommodation of a larger number of students in the Engineering School of the college as well as in the other schools, the raising of a fund of $2,000,000 is now planned. Health and welfare buildings will be erected as the initial step in the college's program for development into the state university when it will be able to admit 10,000 students.

American and Lima Receive Locomotive Orders

It is reported that the New York Central Lines have placed orders for 150 locomotives, half with the American Locomotive Co. and half with Lima Locomotive Works.

Earlier this year the same system placed orders for 75 switching locomotives at an approximate total cost of $2,500,000. The orders just placed will involve expenditure of about $7,000,000.

A National Engineering Museum

After the DeLamater-Ericsson Commemoration on March 9th, the 60th anniversary of the Battle between the Monitor and Merrimac, the American Society of Mechanical Engineers appointed a committee to co-operate with the committee in charge in making a collection of historical material connected with Mr. Cornelius H. DeLamater and Capt. John Ericsson during their 50 years' association (1840-1890) as the leading factors in the DeLamater Iron Works, at the foot of West 13th St., New York City. These works were the largest institution of their kind in their day and there during the period mentioned developments took place in Naval, Merchant-Marine, Ordnance and Industrial Engineering which helped materially to raise this nation from comparative unimportance to its recognition as the leading nation of the world, and yet of the details of this accomplishment there is no record. In fact there is nowhere a tangible record of any of the steps whereby this country has attained its present commanding position in the world.

In seeking for a permanent depository for the DeLamater-Ericsson Historical Collection the committee conferred with the Smithsonian Institution at Washington and its secretary sent with his reply his latest report on the National Museum which is under his custody.

The Smithsonian Institution then not only solicited the placing of the DeLamater-Ericsson Historical Collection in its National Museum but proposed the co-operation of the committee in establishing the nucleus there of a great National Engineering Museum comparable to the foreign museums to record the accomplishments, in the upbuilding of this nation, of its engineers who are only now beginning to secure a recognition of obligations too long deferred.

At the annual meeting of the American Society of Mechanical Engineers, there will be exhibited a part of the historical collection in the Engineering Societies' Building. Such of it as would be appropriate as representing the work of Capt. Ericsson will be sent as requested to the tercentenary of the City of Gothenburg, Sweden, to be held there next summer. On its return it will go with the rest of the collection to the National Museum at Washington.

Lima Locomotive Plans New Financing

The refinancing plan of the Lima Locomotive Works, proposed recently by the Directors, has been approved at a special meeting of the stockholders in Richmond, Va. The plan provides that 48,590 shares of $100 par common stock shall be converted into no par common at the rate of two shares of new stock for one of old. The shareholders likewise will have the right to subscribe, at $50 a share, for 1½ additional shares of no par common stock for each share of existing common stock.

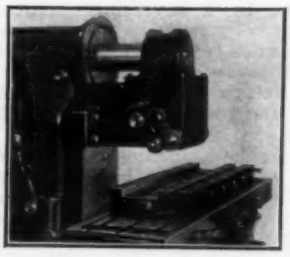
The preferred stockholders may also obtain the right of subscribing to the new common stock by converting their stock into new common.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Attachment, Rack-Cutting, Milling Machine
Rockford Milling Machine Co., Rockford, Ill.
"American Machinist," April 20, 1922

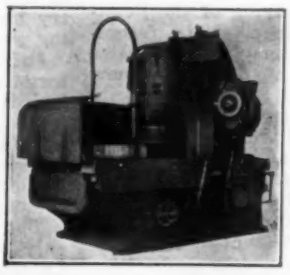
The attachment is used primarily for milling racks and is intended especially for use on the heavy-duty milling machine, but can also be furnished to fit the No. 1½ machine. It clamps to the face of the column of the machine, and is driven from the main spindle. A rack vise and indexing attachment can also be furnished. Racks of different pitches can be indexed by various gear combinations. Eighteen change gears provide for cutting diametral pitches from 3 to 6 by half pitches, all pitches from 7 to 16 and all even pitches from 18 to 32; also circular pitches from ¼ to 1 in., varying by ⅛ in. long that open 5½ inches.



The rack vise has jaws 36 in.

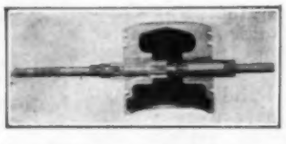
Grinding Machine, Surface, Vertical, High-Power, No. 27-R
Blanchard Machine Co., Cambridge, Mass.
"American Machinist," April 27, 1922

The work is carried on a rotary magnetic chuck and both chuck and table are traversed by power. The annular grinding wheel is 27 in. in diameter and 7 in. deep. A 60-hp., 600 r.p.m. induction motor built into the wheelhead drives the wheel at 580 r.p.m. Power for other purposes is supplied by a 5-hp. motor. A wheel dresser attached to the head provides for dressing the face of the wheel while grinding. The head slides vertically on a massive column. Both hand and power feeds are provided, the power feed giving from 0.0005 to 0.005 in. per revolution of the chuck. Length, 12 ft. 6 in. Width, 7 ft. 6 in. Height, 10 ft. Floor space, 12 ft. 6 in. x 7 ft. Weight, 30,000 pounds.



Reamer, Piston-Pin Bushing, "X-Cel"
Alvord Reamer and Tool Co., Millersburg, Pa.
"American Machinist," April 27, 1922

The cutter and adjustment of this tool are much the same as in the regular Alvord adjustable reamer, but the shank and pilot stem are ground to an accurate sliding fit with the taper plug, and are parallel and concentric with the cutting edges. By passing the pilot stem through the piston-pin bushings, slipping the taper plug on the pilot and pressing it into the bushing, the reamer is centralized and supported, so that it reams the bushings in correct alignment with no chatter. No adjustment is necessary on the taper plug. The reamers are made in eight different sizes, and cover a range from ½ to 1 15/32 in. Set No. 503 consists of four reamers and will ream standard and oversize holes for practically all of the leading cars on the market.



Micrometer, No. 55
Brown & Sharpe Manufacturing Co., Providence, R. I.
"American Machinist," April 27, 1922

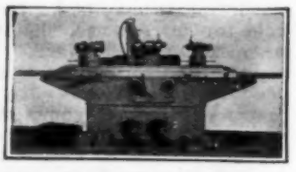
By means of four detachable anvils, the range of the tool is increased, making it adaptable to measurements from 2 to 6 in., instead of from 3 to 6 in. as formerly. The anvils can be quickly changed and are held securely in place by a knurled nut. One anvil is for measurements from 2 to 3 in., another from 3 to 4 in., and so on. The tool is especially useful in garages and service stations where small pistons, many under 3 in. in diameter, and also large pistons for trucks and tractors, require accurate measurement. It can measure all ordinary sizes of pistons.

Stop, Safety, "Simplex"
Atlantic Co., 452 Classon Ave., Brooklyn, N. Y.
"American Machinist," April 20, 1922

The device is intended for attachment to automatic machines and is used as a stop in case of irregularity or breakage of the work, or change in tension, size, or speed. It is operated by current from either a battery, generator, or regular lighting circuit. It is wired in series with a Mazda lamp, which remains unlighted normally because the circuit is open. The contact points are left without current again when the stop has acted. A latch in the stop holds a notched shifter rod that keeps the belt in the running position. If the contact points close the circuit the latch is released, and the spring in the rod immediately moves the belt to the loose pulley or disengages the clutch. A spring providing any force up to 75 lb. can be utilized, so that it is possible to shift a 6-in. belt. The stop itself is 3½ x 2⅝ x 2½ in. in size.

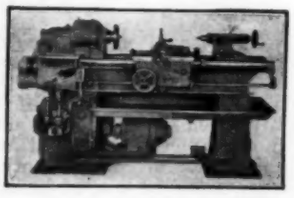
Grinding Machine, Crankshaft, Automotive, Universal, No. 4
Brown & Sharpe Mfg. Co., Providence, R. I.
"American Machinist," April 27, 1922

The machine is used in service shops for grinding automotive parts. With an internal grinding attachment and chuck, it does internal and face grinding, and with a toothrest, it will grind line reamers, milling cutters, and other tools. The throw-blocks are adjustable to different shaft diameters. With the piston arbor, time is saved in mounting pistons. The automatic crossfeed will move the wheel from 0.00025 to 0.004 in. at each reversal of the table. The speeds and feeds of the wheel, work and table are entirely independent. The grinding wheel, 24 in. in diameter, 1 in. thick, has a 5-in. hole, and is protected by a heavy guard. Swing, 22¾ in., 15½ in. over the water guards. Maximum work length, 60 in.



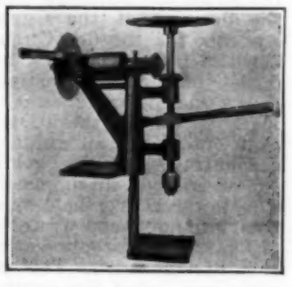
Lathe, Toolroom, 14-Inch
Hendey Machine Co., Torrington, Conn.
"American Machinist," April 27, 1922

The motor is mounted on a shelf beneath the oil pan. It is controlled by push buttons and drives the speed-box through an Oldham coupling. Nine changes of speed are controlled by the two levers on the front, while the ratio of the back gearing makes nine additional speeds available, giving eighteen speeds in all. The complete range of threads and feeds provided is controlled by the two upper levers. The spindle end thrust bearing distributes the load evenly over the wearing surfaces and makes adjustment easy. The crossfeed and carriage traverse give accurate tapers or bevels when the two are used together. The tail spindle is graduated. The treadle along the front of the base serves to stop the lathe, without stopping the motor.



Bench Machine, Combination, "Reeves"
Ster-O-Lock Manufacturing Co., 417 So. Dearborn St., Chicago, Ill.
"American Machinist," April 27, 1922

This machine is a combination tool intended for use in the garage or service station, and can be used for drilling either wood or metal, for surfacing or sanding, disk grinding, polishing, buffing, rough or tool grinding, or for rip-sawing wood. The table through which the rip-saw protrudes can be entirely removed, or tilted for sawing at an angle. The horizontal disk at the upper end of the spindle is for disk grinding or surfacing. The vertical spindle has a range of 3½ in. without adjustment, and is supplied with a Jacobs chuck that will take drills up to ½ in. The drilling table is adjustable.



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Business Items

The United States Pipe & Foundry Co. is installing four machines for the manufacture of cast iron pipe by the de Lavaud method at its North Birmingham plant.

The Wright Aeronautical Corporation, for the quarter ending June 30, 1922, reports net sales of $667,037 and net profits after $136,340.

The Chicago & Eastern Illinois Railway, for four months ended April 30, 1922, reports a net income of $325,856, after taxes and charges.

The Norfolk and Western Railway Co. reports gross earnings for June of $9,474,614, an increase of $2,417,224 over the corresponding month of 1921.

The Southern Pacific Co., for the six months ending June 30th, reports a net revenue from railway operations of $27,958,826, an increase of $5,014,210, over the same period of last year.

The National Tool Co., Cleveland, Ohio, has purchased the business of the SaveAll Tool Co., Waltham, Mass., manufacturers of the SaveAll Chuck. J. C. Dufresne will remain in the capacity of manager of the SaveAll department.

The Herberts Machinery and Supply Company, Los Angeles, Calif., announces that it has acquired the exclusive sales rights of the Gisholt Machine Co., Madison, Wis., for the states of Arizona, California and Nevada.

The American Refrigerating Machine Co., Inc., Hartford, Conn., has been incorporated under the laws of Connecticut to engage in the refrigerating machinery and tools of all kinds. The capital stock of the company is $50,000, and the incorporators are: Edward Carlson, Samuel Gilbert, and Gustaf Bernston, all of Hartford.

The Coppus Engineering Corporation, Worcester, Mass., industrial engineering and equipment, has recently been incorporated with a capital of $500,000, succeeding the Coppus Engineering and Equipment Co., incorporated in 1912, The concern manufactures steam turbines, pumps, turbine blowers, etc. The incorporators are: Frans H. C. Coppus, president; Otto Wachsberg, and Linwood M. Erskine, all of Worcester.

The C. G. Garrigus Co., Haddam, Conn., recently incorporated to manufacture and deal in machinery, tools, hardware, etc., with a capital of $50,000, organized last week with the election of Clarence G. Garrigus, president and treasurer; Howard L. Webster, vice-president; Alfred C. Garrigus, assistant treasurer and secretary; and Harold I. Arms, assistant secretary.

The Hi-Power Tool Corporation, Jackson, Mich., recently incorporated with a capital of $75,000, has taken possession of the plant formerly occupied by the Jackson Machine Co. and production is expected to start within the next thirty days. The officers of the new company are: M. C. Townley, president; Watson R. Smith, treasurer and general manager; Thomas Woodfield, vice-president, all of the city of Jackson. Richard W. Hansen, formerly with the Illinois Tool Co., Chicago, has been retained in the capacity of engineer to develop a line of hobs, reamers and milling cutters. Arthur Knapp, formerly of the Goddard Tool Co., will be sales manager and T. G. Trocke, also formerly with the Goddard Co., will be production manager.

The Penn Seaboard Steel Corporation, for the six months ended June 30, 1922, reports a deficit of $571,687, after charges and inventory adjustments.

The American Metal Co., Ltd., and subsidiary companies for quarter ended March 31, 1922, reports a net income of $508,304 before depreciation but after interest charges.

The Hercules Powder Co. reports net earnings for the first six months of the current year of $717,326, equivalent to $5.50 per share on the $7,150,000 common stock.

The American La France Fire Engine Co., for the six months ending June 30, 1922, reports operating profits of $456,970 as compared with $452,653 in the corresponding period of 1921.

The Delaware, Lackawanna and Western Railroad Co., in its report for June, 1922, shows gross earnings of $5,501,267 as compared with $7,566,132 in June, 1921. The decrease in earnings is attributed to heavy losses in traffic due to the coal strike.

The Otis Steel Co., Cleveland, has just issued $5,000,000 first mortgage, twenty-five year 7½ per cent gold bonds, the proceeds of their sale to be used in the construction of four open-hearth furnaces, a blooming mill, a sheet bar mill and a strip mill of 84,000 tons annual capacity.

The Ontario Steel Products Co., Ltd., Toronto, for year ended June 30, 1922, reports a profit of $141,083 compared with $223,446 in previous year. After deduction of interest, depreciation, dividends and inventory reserve, deficit was $150,987 against surplus of $32,946 in preceding year.

The B. F. Goodrich Co., for six months ended June 30, last, before interest and depreciation charges, reports net earnings of $3,877,000. After interest of $1,527,483 and depreciation of $1,037,836, net profits before federal taxes were $1,312,000, about equal to preferred dividend requirements for the period.

The Smith & Furbush Machine Co., and Proctor & Schwartz, Inc., both of Philadelphia, manufacturers of textile machinery, have been merged into a new company to be known as Procter & Schwartz, Inc., with a capitalization of $2,500,000. The officers of the new consolidation will be: Walter M. Schwartz, president; E. B. Ayers, Frederick Kershaw and Thomas W. Allen, vice-presidents; and Frank E. Schermerhorn, secretary and treasurer.

The Studebaker Corporation, for the second quarter of the current year, reports net profits of $7,086,552, after deducting for federal tax reserve. This is equivalent to $11.52 per share on the $60,000,000 common stock after preferred dividends and compares with $4,069,848 in the first quarter, equivalent to $6.49 per share on the same issue.

The Ford Motor Co. is reported to have produced 141,941 cars and trucks during the month of June in its American and foreign plants, an increase of 13,698 over May. This brings the half year total to 551,382 cars and trucks as against 442,142 in the corresponding period of 1921.

The Stewart Warner Speedometer Corp. for quarter ended June 30, 1922, reports profits before taxes of $1,605,267, the largest in the history of the company, comparing with $601,945 in second quarter of 1921. For first half 1922 profits totaled $2,121,686, against $652,872 in same period of 1921.

The Roach-Appleton Manufacturing Co., 2446 North Crawford Ave., Chicago, has been recently incorporated for $100,000 for the purpose of manufacturing electrical specialties, such as protecting materials and also special stampings and assemblies. The officers of the company are: Ernest G. Appleton, president and treasurer; Walter O. Roach, vice-president and general manager, John N. Wilson, secretary, all of whom were formerly connected with the Chicago Fuse Mfg. Company.

Personals

JAMES C. POTTER, president of the Potter and Johnston Machine Co., manufacturer of machine tools, Pawtucket, R. I., recently returned from his business trip to Europe.

H. WALES LINES, president of the Meriden Machine Tool Co., forming turret and spinning lathes, Meriden, Conn., was elected a vice-president of the Meriden Savings Bank at its recent annual meeting.

W. C. DURANT, president of the Durant Motors, Inc., New York, has become president of the Locomobile Company of America, makers of the well-known Locomobile pleasure automobile, and the Riker trucks, Bridgeport, Conn.

FRED W. HOWE, vice-president of the Crompton and Knowles Loom Works, Providence, R. I., returned home last week after a three months' trip in China and Japan.

E. V. SWANGREN, formerly vice-president and superintenedent of the F. J. Littell Machine Co., Chicago, and W. N. STEVENSON, formerly secretary and chief engineer of the same company, announce the formation of a partnership to be known as the S. & S. Machine Works, 4522 Lexington Street, Chicago.

CHARLES L. HAROLD, secretary of the Birmingham Civic Association, and also of the Southern Association of Rolled Steel Consumers, has resigned his position and will shortly enter upon a new line of activity.

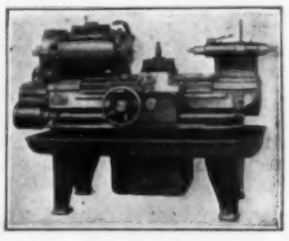
H. F. BARRUS, who, for a number of years past, has been identified with the Union Twist Drill Co., Athol, Mass., will sail for England early in September where he will take up his new duties as general manager of Barrus & Cullen, of London.

A. A. MURPHY, for many years past connected with Du Pont sales activities, has been appointed resident sales manager of the industrial and railway paint and varnish division of E. I. du Pont de Nemours and Co., with headquarters at 30 Church Street, New York City,

Condensed-Clipping Index of Equipment

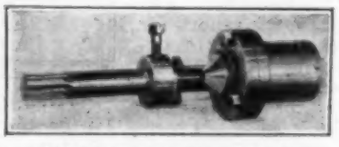
Patented Aug. 20, 1918

Lathe, Manufacturing, "Sundstrand," 12-In.
Rockford Tool Co., Rockford, Ill.
"American Machinist," April 27, 1922



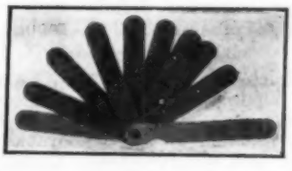
The machine is constructed on the same general principle as the 9-in. lathe but has a greater swing and adaptability. It is equipped with crossfeed, quick-change feed and reverse to the carriage, and is adaptable also to thread cutting. The drive is of the single-pulley type. An extension is provided at the outer end of the spindle for attaching air cylinders, draw-in attachments and expansion chucking devices. Swing: over carriage, 12 in.; over cross-slide, 10 in. Distance between centers, 18 in. Speed of drive pulley, 200 r.p.m. Number of feeds, 29. Number of spindle speeds, 9. Floor space, 35 x 70 in. Weight, 3,500 lb.

Reamer Holder
Marvin & Casler Co., Canastota, N. Y.
"American Machinist," April 27, 1922



The holder is used on screw machines or lathes and is not intended to float. The bushing or adapter sleeve is mounted on the turret of the lathe. After the work has been bored, the cone-shaped centering plug in the holder faceplate enters the hole to make the faceplate concentric with the lathe spindle. Capscrews are tightened to secure the faceplate. The plug is removed and the reamer holding sleeve is inserted. This sleeve holds the center line of the reamer on the center line of the work and of the machine spindle. Faceplates, holder sleeves and center plugs are interchangeable, and the sleeves can be supplied in sizes to suit the reamers used.

Gage, Thickness, Feeler, Locking
Lufkin Rule Co., Saginaw, Mich.
"American Machinist," April 27, 1922

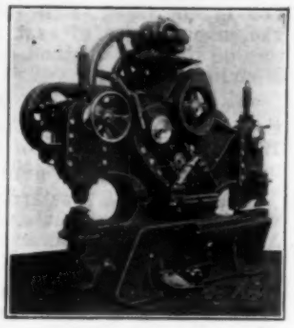


The thickness or feeler gage is adapted particularly to the use of automobile mechanics and repair men, and is provided with a lock which consists merely of a knurled head nut that clamps the leaves tightly together. Fits can be gaged in places difficult of access. The gage is made in several styles with from six to nine leaves. The No. 109 tool shown has a case in which the blades fold. On all styles the leaves are ½ in. wide and 3 in. long and can be easily removed. If two leaves are separated from the others and locked in position, they may be used as the upper and lower limits for a fit. When the gage is closed and locked, the blades are protected.

Sand-Cutting Machine, Power, Type HP
American Foundry Equipment Co., 336 Madison Ave., New York, N. Y.
"American Machinist," April 27, 1922

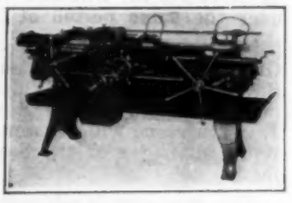
The machine is for use in foundries for cutting and tempering sand. It is similar in general construction to the former model. Blending, mixing and tempering may be accomplished without any accessory mechanism, and sand may be piled or thrown into windrows. The drive wheels are driven by a motor running in either direction at two speeds of 15 and 45 ft. per minute. By tilting the frame by means of the handwheel at the front, the cutting cylinder can be lowered into the sand. This cylinder is driven by a 2-hp. motor. Length, 91 in. Width, 63 in. Cutting cylinder length, 44 in. Weight, 1,500 pounds.

Punching and Shearing Machine, Combination, Triple, Ocking
Amplex, Inc., 6 West 32d St., New York, N. Y.
"American Machinist," April 27, 1922



The machine does not occupy much floor space, and can be adapted to different types of work without changing tools. On the operator's side it is clear of encumbrances such as flywheels and driving gears. It has a slanting centering slide. The plate shear has longer knives than in the former models. The frame is cast steel. The smallest size machine is the No. 13, which will split ½-in. plates and cut 3½ in. angles, with a punching capacity of ⅝-in. holes in ½-in. material. The largest size machine is the No. 32, which will split 1¼-in. plates, cut 8 x 8 x ¾ in. angles and punch 1⅜-in. holes in 1-in. material.

Staybolt Machines, Horizontal, Styles A and B
Dale Machinery Co., Inc., New York, N. Y.
"American Machinist," April 27, 1922



The style B machine illustrated is used for turning simultaneously taper and straight diameters on staybolt forgings and for threading continuously and simultaneously both the straight and taper ends. The front head has an adjustable taper attachment. Both dieheads are automatically tripped at the end of the cut, and are automatically closed. The style A machine is used to make side stays from the bar and turns the relieved portion in the center of the bolt and threads both ends in uniform pitch and continuous lead. A hexagonal turret is mounted on a slide, moving directly on the ways of the machine. The stock is fed through the spindle and automatic chuck by the bar feed.

Etching Pencil Outfit, Electric
Luma Electric Equipment Co., 405 Spitzer Bldg., Toledo, Ohio
"American Machinist," April 27, 1922

The device, consisting of a magnetic table and the pencil itself, is adaptable to etching or writing on hardened steel, demagnetizing steel, annealing and soldering. By using the magnetic table, work that has been placed on a magnetic chuck can be easily demagnetized, or tools may be magnetized. When used in annealing, the cord of the pencil is attached to the top connection on the side of the instrument, and the point is replaced by one of carbon. The outfit is operated from an ordinary lighting circuit of 110-volt, 60-cycle, alternating current.

Furnace, Forging and Rivet-Heating, Oil-Burning, Portable
Wayne Oil Tank and Pump Co., Ft. Wayne, Ind.
"American Machinist," April 27, 1922

The forging and welding furnace is used in shops where it is necessary that the equipment be moved about. The tank will withstand a working pressure of 100 lb. per square inch and is fitted with a safety valve. The 2-in. air-tight filling opening is conveniently located. The fireclay shapes can be quickly renewed. Air pressure is obtained by connecting the furnace to the compressed-air line which supplies the riveting hammers. Work opening: Width, 6 in.; height, 3 to 4 in. Height, 51 in. Depth, 25 in. Width, 31 in. Weight, 600 lb.

Clip, paste on 3 x 5-in. cards and file as desired

where the company's paint and varnish division has recently opened new offices.

ROBERT W. APPLETON, production engineer of the Pierce Arrow Motor Car Co., Buffalo, N. Y., has been appointed manager of purchases of the company. Mr. Appleton, who will also continue his duties as production engineer, has been identified with the Pierce Arrow factory for more than twenty years.

CHARLES F. GOEDKE of the William Ganschow Co., Chicago, Ill., has been elected treasurer of the American Gear Manufacturers' Association.

A. J. WURTZ, professor of electrical engineering at the Carnegie Institute of Technology has retired from the staff of that department to devote his entire attention to research work in that subject for the division of co-operative research.

E. B. PHILLIPS, for the past two years instructor in electrical engineering at the U. S. Naval Academy, has been appointed instructor in the same branch of study at the Carnegie Institute of Technology, Pittsburg.

R. E. CAROTHERS, formerly manager of the turbine section, Westinghouse Electric and Manufacturing Co., Pittsburgh, has been appointed manager of the steam turbine division of that company.

JAMES A. BEAUBIEN has been appointed manager of the New York office of the Pennsylvania Pump and Compressor Co., Easton, Pa., and will be located at 30 Church Street, New York City.

CHARLES F. LLOYD, formerly manager of the Substation Section, Westinghouse Electric and Manufacturing Co., Pittsburgh, has been made manager of the electric division of the company.

WENDELL E. WHIPP, manager of the Monarch Machine Tool Co. and president of the Whipp Machine Tool Co., Sidney, Ohio, addressed the Kiwanis Club of that city on business conditions at its recent meeting.

BRUCE H. LYTLE has been promoted to the position of manager of the substation section, Westinghouse Electric and Manufacturing Co., Pittsburgh.

A. B. NEUMAN, for a number of years past engaged in consulting engineering work in Chicago, has been appointed manager of the branch sales office in that city of the Mesta Machine Co., Pittsburgh, Pa.

Obituary

CHARLES E. THWING, sales manager of the Worcester Lathe Co., Worcester, Mass., died at his home in that city, July 9, after five months' illness at the age of 61 years. He was one of the best known lathe salesman in the country, and began his career as a bookkeeper for the Lathe and Morse Tool Co., Worcester, of which his father, Edwin A. Thwing was for many years agent. At one time Mr. Thwing was sales manager for the Whitcomb-Blaisdell Machine Tool Co., Worcester, leaving that company to become treasurer of the Draper Machine Tool Co., Worcester. This company later was taken over by the Whitcomb-Blaisdell Machine Tool Co. and Mr. Thwing went with it. When Alonzo W. Whitcomb, president, left the company some years ago and started the Worcester Lathe Co., Mr. Thwing joined him in his old capacity.

EDWARD R. CALDWELL, founder of the E. R. Caldwell and Son Brass Co., Syracuse, N. Y., died at his home in that city recently at the age of 58 years after a long illness. He organized the Central Brass Co. here 31 years ago, and later the Caldwell & Ward Brass Co., both still in operation.

PETER ECKEL, president of the Eckel-Nye Steel Co., Syracuse, N. Y., died recently at the Memorial Hospital in that city following an operation, at the age of 67 years. Mr. Eckel was at one time superintendent of the Sweet Manufacturing Co. and later was with the re-organized Sweet Steel Co. of Syracuse. With his brothers he founded the Eckel-Nye company about twenty-five years ago.

Book Reviews

The Gantt Chart. By Wallace Clark. Published by the Ronald Press Co., New York City. N. Y.

Mr. Clark writes as the acknowledged literary executor and disciple of Henry L. Gantt among whose contributions to the science of more intelligent management were undoubtedly the control and progress charts which have come to bear his name. This book is eloquent testimony to the truth that all big and good ideas are essentially simple. The idea that it is good business to utilize a method of charting the amount of idle time of machines, of recording the actual as against the expected production of individual workers, of showing by simple bar charts the progress of work within departments and by departments—this does not sound profound, nor yet strikingly ingenious. Yet it took Mr. Gantt and his co-workers to develop a technique of chart design and procedure which had never before been worked out, which has given effective results in practice, which has applications to many types of control problems not yet fully realized.

Mr. Clark's is deliberately a book of elementary exposition. It is most useful too, and the industrial statistician, administrative accountant and co-ordinating executive will find suggestions in the text which can be turned to good account. Administrators will find here a practical statement of how one group of engineers applied a sound principle of management. The literature of scientific methods of business control is definitely enriched by this contribution, well deserving of a place on the desk of every executive.

Production Engineering and Cost Keeping for Machine Shops. By Wm. R. Basset and Johnson Heywood. 311 pages, 6 x 9 in., 115 illustrations. Published by the McGraw-Hill Book Co., New York. Price $3.50.

Having as its basis the articles which appeared in *American Machinist* under the title of "Modern Production Methods," this book takes up many subjects which are of vital interest to all who have to do with the economical production of machinery or machine parts. The twenty-six chapters include planning, purchasing, stockkeeping, engineering, tools, shop layout, central control of production and the control of work in the shop. Planning work in a jobbing shop will appeal to many, as most shops have more or less work which comes under this head. Time study fundamentals, setting standards and piece rates as well as special cases of each are given careful attention, while time study on automatic machines has a short chapter of its own.

The fundamentals of cost systems are taken up and the authors point out just what benefit they can be expected to confer. Fixed charges, the various phases of overhead expense, analyzing labor costs, accounting for supplies and getting the overhead into the finished product, are treated in considerable detail. The last five chapters deal with the handling of abnormal expense, the gathering of final costs; statements, both of conditions and operating; the cost of selling and graphic methods of control. These give just the points which are needed by many shop managers, and not always in small shops either.

The various subjects are handled in clear and easily understandable language and the many examples help to make them plain in every way. The authors are evidently students of shop psychology as well as systems, which adds materially to the value of the book. The effect of certain methods on men is discussed from a broad viewpoint which will aid managers who have not been through the shop in understanding the men's reaction on various matters. It is a thoroughly practical book and one which can be heartily recommended to managers and to shop executives who wish to go up the ladder.

Trade Catalogs

Self-Opening Die Heads and Collapsible Taps. The Victor Tool Co., Waynesboro, Pa. A booklet showing installations of the Victor self opening die heads and collapsible taps in machine shop work. The booklet also describes the nut facing machines and the floating reamer holders made by this company.

Automatic Electric Furnaces. Automatic and Electric Furnaces Limited, 281 Grays Inn Road, London, W. C. 1, England. A twenty-page catalog describing the Wild-Barfield automatic electric furnaces for steel hardening. The catalog contains a general description of the product, a theoretical and practical discussion of the pyroscopic detector data on vertical hardening and flat furnaces and information relative to oil tempering and salt tempering baths. Illustrative and descriptive matter on air tempering muffles, maturing ovens, pyrometers, and magnetic sclerometers is also given.

Rapid Production Lathes. The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. A special bulletin of eleven pages, just issued, giving a detailed description with numerous illustrations of the LeBlond 11 inch heavy duty rapid production lathe. The bulletin also contans complete specifications covering the machine.

Multi-Cut Lathes. The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. A new general catalog containing complete descriptive matter on and illustrations of the LeBlond multi-cut lathe. Set forth in the catalog are detailed descriptions on the special features of construction with numerous halftones and line cuts. Typical multi-cut tool layouts are featured and setting table for the machine is given. On page 29, by means of line drawings, are shown samples of parts of various styles on which the machine has effected time saving in machining.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., October 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

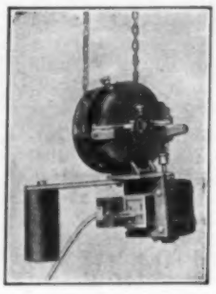
National Machine Tool Builders' Association. Annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Hoist Operator, Chain, "Handiman"
New Jersey Foundry and Machine Co., New York, N. Y.
"American Machinist," April 27, 1922

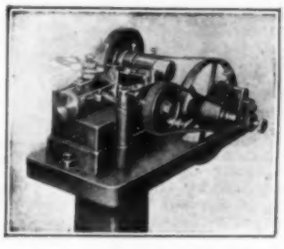


The device is for operating hand-power hoists of 5-ton or larger capacity and is an electrically driven machine that may be suspended in the bight of the operating chain. It has a capacity to overhaul 138 ft. of chain per minute, with a chain pull of 150 lb. It is driven by a ¾-hp. motor attached to the frame and running in either direction. The worm-wheel shaft carries a grooved sheave with a V-shaped rubber tread to fit any size and pitch of operating chain and to prevent slipping. The machine is counter-balanced. Current may be supplied from a lamp socket. Weight, 165 pounds.

Gear-Tooth Rounding Machine
Cross Gear and Engine Co., Detroit, Mich.
"American Machinist," May 4, 1922

The machine is for accurately rounding at high speed the tooth corners of straight and helical spur gears and of spiral bevel gears and pinions. The cutter is rotated by a pulley on the head. To suit the tooth thickness, the eccentricity of the cutter spindle housing can be varied by means of an adjusting screw. The machine is made in three sizes, can be furnished with special heads for carrying the gears, and can be equipped for motor drive. Capacities: No. 1, up to 4-pitch, 24-in. diameter, and up to 2-pitch, 16-in. diameter; No. 2, up to 4-pitch, 36-in. diameter, and 2-pitch, 30-in. diameter; No. 3, 1- to 4-pitch, up to 60-in. diameter.

Sharpening Machine, Saw, Automatic, No. 2
George Scherr, 126 Liberty St., New York, N. Y.
"American Machinist," May 4, 1922



The machine is larger than the No. 1 model, and is intended for sharpening circular saws from 1½ to 8 in. in diameter. It is used on all types of circular metal saws, screw slotting cutters and jewelers' and slitting saws. Saws up to $\frac{5}{32}$-in. thick with holes from ⅜ to 1 in. in diameter can be handled. Indexing is done by means of the saw being sharpened, although saws with broken teeth can be handled. The machine measures 12 x 24 x 36 in., the column being 30 in. high. Wheel, 4½ x ⅜ in. Weight, 135 pounds.

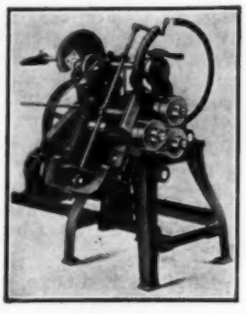
Planer and Jointer, Hand, Portable, Motor-Driven, 4- and 6-In., No. 133
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," May 4, 1922

The machine is intended to replace the hand plane when jointing and fitting wood. The 6-in. machine has a ½-hp. motor and planes 6½ in. wide, while the 4-in. machine has a ½-hp. motor and planes 4½ in. wide. Both sizes rabbet up to ½ in. The tables are raised and lowered by means of hand-wheels and screws. The cutter head is fitted with three knives, and is directly connected to the electric motor, operating at 3,600 r.p.m. on either a. c. or d. c. of 110 or 220 volts. An attachment for setting and sharpening the knives and a floor column can be furnished.

Grinder, Heavy-Duty, A. C. Motor
J. G. Blount Co., Everett, Mass.
"American Machinist," April 27, 1922

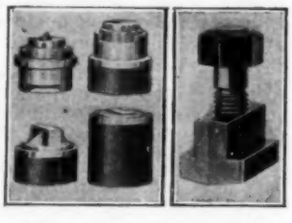
The grinder has a 5-hp. heavy-duty motor and is made for wheels 18 x 3 x 1½ in., or 16 x 3 x 1½ in. The end shields are of cast iron, turned with a recess and bolted directly to the motor frame. Adjustable wheel guards are furnished either plain or of the exhaust type. The work supports are adjustable. The safety starting switch is mounted within the column on a separate panel. The machine is furnished with an a. c. motor either for 220- or 440-volt, 60-cycle, 2- or 3-phase, or for 550-volt, 60-cycle, 3-phase current. Weight, 1,200 pounds.

Bending Machine, Angle, No. 14
Excelsior Tool and Machine Co., East St. Louis, Ill.
"American Machinist," May 4, 1922



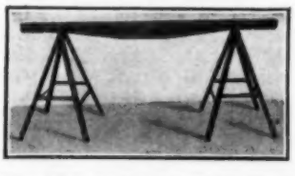
The machine is used for bending angle iron into circular form. Bar and T-iron can also be formed with the same rolls, but special rolls are required for pipe and channel iron. All three roll shafts are driven, so that small circles can be rolled by one pass through the machine with the flange on either the inside or the outside. The machine, which may be furnished either with or without the cutting attachment or the motor drive, requires 3 hp. to operate. Capacity, angle iron up to 2 x 2 x ¼ in. Height, 5 ft. Floor space, 4 x 5 ft. Weight, 1,800 pounds.

Furniture, Machine, Jack, Blocks and T-Slot Nut
Marvin & Casler Co., Canastota, N. Y.
"American Machinist," May 4, 1922



The equipment is used on the tables of machine tools when setting up work. The T-slot nut shown at the right is generally used when an additional clamp is placed on work secured to a machine table. Diameter, ½ to 1 in.; length, 1½ to 3 in.; width of head, 1 $\frac{1}{16}$ to 2 in. At the left are shown jacks used on machine tables for leveling work. The jack screw is of fine pitch, has a point at one end and a flat surface on the other, and can be extended ⅝ in. The tubular extension blocks are placed under the jack to increase the height. Minimum height of jack: to top of point, 1⅞ in.; to top of surface, 1½ in. Extension blocks: outside diameter, 2⅜ in.; lengths, 1, 2½, 4¾, 9½ inches.

Trestle, Steel, Demountable, "Eureka"
Reinhold Bettermann, Johnstown, Pa.
"American Machinist," May 4, 1922



The trestle is for use in an industrial plant to support work. Each stool has four legs braced together to form a pyramid. The stools can be used individually for supporting automobile rear axles; and they can be supplied with a special slot at the top, for use under axles fitted with truss rods. To form the trestle, two stools support the T-bar. Notches in the bar allow the distance between the stools to be varied. Height, from 13½ to 30 in. Weight, from 11 to 30 lb. Trestles with the legs riveted to the T-bar can also be supplied with a standard height of 30 in. and a length of 42 inches.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Birmingham—East Pratt Coal Co., 621 Chamber of Commerce Bldg., T. W. Morgan, Pres.—one vertical drill press up to 3½ in. drill.

Fla., Buena Vista—Buena Vista Automobile Works—complete garage machinery and equipment, including lathe, drill press, reamer, and small tools (new or used).

Mass., Fitchburg—Fitchburg Pumping Mchy. Co., H. Gordon, Dir.—additional machinery and tools for proposed $125,000 plant at East Akron, O.

Mass., Woburn—Massachusetts Gear & Tool Co., E. R. Lyman, Mgr.—one Universal grinder, No. 1 Brown and Sharpe or equivalent, with complete equipment including internal grinding attachment, also Cincinnati No. 1½ cutter and tool grinder, or equivalent.

Mich., Saginaw—Miles Mchy. Co., 205 Bearinger Bldg.—cut-off machines, drills, key seaters, milling machines and other tools.

Miss., Jackson—Lauchley Fdry. Machine Co., B. W. Lauchley, Pres.—equipment for foundry and machine shop.

N. J., Patterson—The Sipp Machine Co., Erie R.R., Keen and Warren Sts., W. Toll, Asst. Secy.—one automatic threading lathe (used).

N. Y., Buffalo—C. F. Dunning, 1480 Jefferson Ave.—equipment for automobile repair shop.

N. Y., New York—The New York Central R.R., Grand Central Station, Purch. Dept.—one motor driven improved 6 spindle vertical bolt threading and turning machine, capacity up to 36 in. long.

O., Cleveland—The Bd. of Educ., East 6th St. and Rockwell Ave.—one motor drive wood lathe, No. 20C, complete with 220 v., d.c. motor, with starting box. Also the following equipment for Patrick Henry, Rawlings and Audubon Schools, (previous bids have been rescinded)—two hollow chisel mortiser, block sander, 4 bar folding machines, 4 punch and shear machines, 4 forming rollers, 4 burring machines, 4 turning machines, 2 wiring machines, 2 hand forges, 2 variety saw benches, 2 cabinet planers, 2 combined oil stone grinders, 4 lathes, 4 10 in. bench drills, 4 two-wheel grinders, 4 squaring shears.

O., Columbus—White Machine Co., 240 North High St., C. White Pres.—machine tools, including drill press, lathe, 24 in. grinders, etc.

Okla., Tulsa—McCann Motor Co., 633 North Main St.—one 16 in. power lathe.

Pa., Phila.—Roberts & Manders Stove Co., 11th St. and Washington Ave.—foundry machinery including cranes, boring machines, drills, etc.

Wis., Appleton—Herman Motor Co., 680 College Ave.—machinery for auto repair shop.

Wis., Black Earth—R. A. Hermann—equipment for auto repair shop.

Wis., Milwaukee—General Battery & Motor Service, 1008 29th St., A. Ebener, Purch. Agt.—machinery for auto repair shop.

Wis., Milwaukee—Heller Elevator Co., 250 Milwaukee St.—planer and lathe.

Wis., Milwaukee—J. Kokotez, 511 National Ave., (auto repairs)—repair machinery including drill press.

Wis., Milwaukee—A. A. Magritz, 1078 25th St.—sheet metal working machinery.

Wis., Watertown—Klinger & Mayer, 200 1st St.—machinery for automobile repairing, including crane and power press.

Que., Montreal—H. Rayment, 412 1st Ave. Rosemont—complete equipment for garage and automobile repairs.

Que., Montreal—O. Roberts, 340 Hingston Ave.—complete equipment for automobile repair shop.

Que., Westmount—F. S. Cape, 460 Wood Ave.—equipment for garage.

Machinery Wanted

Fla., Brooksville—Florida Veneer & Grate Co., J. Coogler, Purch. Agt.—one mortiser, tenoner, rounding and nailing machines and other miscellaneous machinery for the manufacture of boxes (new or used).

Fla., Lake Eustis—Lake Eustis Fruit Co., B. Dillard, mgr.—machinery for proposed fruit canning factory.

Fla., Ocala—Smoak & Goni—woodworking machinery for the manufacture of automobile and truck bodies, including various saws, jointer, tenoner, sander, etc., also small tools for automobile and tire repairs (used or new).

Fla., Tampa—Consumers Ice Co., Polk and Marion Sts.—will receive bids until Oct. 1 for ice machinery for proposed plant, 30 ton daily capacity.

Ga., Mt. Airy—W. A. Smith—cotton mill machinery, capacity 5,000 spindles.

Ind., Goshen—News Printing Co.—linotype machine, model K.

Kan., Wichita—R. W. Parks, 1832 South Wichita Ave.—one 18 in. planer for cabinet work.

Ky., Ashland—Pittsburgh Brick & Tile Co., c/o S. S. Willis—machinery and equipment for brick manufacturing plant at Summit.

Mass., Worcester — Ettrick Finishing Wks., Box 445—two Woonsocket nappers, 90 in. long, double action.

Minn., Duluth—McDougall Terminal Warehouse Co., 510 Alworth Bldg.,—equipment for refrigerating and artificial ice plant on Railroad St. and 9th Ave. W.

Minn., Frazee — Frazee Co-operative Creamery Co., F. O. Anorison, Mgr.—one 10 ton ice machine, 2 cream vats, and one 30 hp. boiler.

Miss., Hattiesburg — Hattiesburg Pine Oils Co., V. M. Scanlon, Pres.—machinery and equipment for the manufacture of turpentine, oil and various pine oil products.

Neb., Lincoln—Lincoln Rug Factory, 2373 O St., D. O. Pettit, Pres.—power cutting and fraying machine; power or hand looms for making rugs; machinery for rug cleaning.

N. J., Hammonton—Littlefield Ice & Coal Co.—complete refrigeration machinery and equipment for proposed ice plant.

N. Y., Buffalo—O. E. Bray, 1009 Mutual Life Bldg.—special machinery and equipment for the manufacture of patented Plankstone (concrete blocks treated with other materials), for several factories in western New York.

N. Y., Buffalo—H. S. Lockwood, 220 Triangle St.—printing equipment for proposed plant on South Park Ave. and Reading St.

N. Y., Jamestown—Lindbeck Lumber & Mfg. Co., 16 River St. (manufacturers of wood work, trim and dealers in lumber)—conveying and woodworking machinery for new addition to factory.

N. Y., North Tonowanda—Transfer Lumber & Shingle Co., Main St., C. Betz, Purch. Agt.—machinery and equipment for the manufacture of stained shingles, for proposed plant at Minneapolis, Minn.

N. Y., Owego—Gotham Shoe Co., Church St.—machinery and equipment for proposed shoe factory on Church St.

N. Y., Rochester—Vacuum Oil Co., 926 Exchange St.—machinery and equipment for proposed barrel washing plant.

N. Y., Tonowanda—The Transfer Lumber & Shingle Co.—machinery and equipment for stained shingle plant in Minneapolis, Minn.

N. C., Newton—S. D. Houk, c/o Newton Oil & Fertilizer Co.—machinery for proposed fertilizer mill.

N. C., Winston-Salem—Fogle Furniture Co., F. A. Fogle, Pres. and mgr.—woodworking machinery for furniture factory.

O., Columbus—Clark Show Case Co., 31 West Chestnut St.—wood and metal working machinery.

O., Dennison—Dennison Lumber Co., J. C. Roby, genl. mgr.—woodworking machinery for planing mill.

O., Niles—Atlas China Co., A. H. Ahrendt, Pres.—machinery and equipment for proposed addition to plant.

O., South Akron (Akron P. O.)—Washington Rubber Co., (manufacturer of rubber specialties)—equipment to replace that which was destroyed by fire.

Pa., Ellwood City—Consolidated Stone & Mining Co.—complete equipment and machinery for proposed cement block factory on Wampum Rd., capacity 21 blocks per minute.

Pa., Grove City—McKays Carriage Wks., Brie Ave.—machinery for 1-story factory addition.

Pa., Phila.—Apex Hosiery Co., Lawrence and Luzerne Sts., W. Meyer, Purch. Agt.—full fashion knitting machines including latch needle machine and dyeing machinery.

Pa., Phila.—Huges & Bradley Co., 10th St. and Washington Ave., J. C. Wollman, Purch. Agt.—circular and flat knitting machines, and hand frame looms, for textile manufacturing plants.

Pa., Phila.—E. L. Mansure & Co.—1415 North St.—looms for new textile manufacturing mill.

Pa., Phila.—Motor Exchange, 327 North 3rd St.—chain hoist, 40 ft. lift.

Pa., Phila.—Wilson & Co., 10 South 18th St.—additional presses and equipment for print shop.

Pa., Pittsburgh—H. C. Frick Coke Co., Carnegie Bldg.—mammoth belt in 20 separate lengths of rubberized fabric, length over all about 9 miles, 4 ft. wide, ¾ of an in. thick 350 tons, for use in coal mines for carrying coal through a four mile tunnel.

Pa., Reading—E. R. Meinig, McKnight St. bet. Greenwich and Oley Sts.—complete machinery and equipment for proposed 7 story hosiery factory.

Pa., Scranton—E. H. Schlesser, 1006 Scranton St.—paint shop machinery and spraying apparatus and complete mechanical equipment for large addition to garage and paint shop.

Pa., Vandergrift—Bd. of Educ.—equipment for vocational department of proposed High School.

Pa., Warren—Crescent Furniture Co.—machinery for furniture factory, including planers, saws, stickers, etc.

S. C., Beaufort—Beaufort Gazette, S. F. Sherman, Mgr.—$10,000 worth printing machinery for proposed publishing plant.

S. C., Sumter—Sumter Ice & Fuel Co., E. H. Moses, Mgr.—machinery for proposed creamery and ice plant.

Tenn., Waverly—J. P. Cowe Co. (cotton mill)—knitting mill machinery for the manufacture of hosiery.

Va., Rich Creek—Ace Lumber Co., T. E. Ballard, Secy.—mill and woodworking machinery (used or new).

Va., Wytheville—R. P. Johnson—one 4 side planer and matcher to handle lumber up to 20 in., also self feed rip saw, (used).

Wis., Bavaria (Gleason P. O.)—H. Brei, Route 1—cheese making machinery and vats.

Wis., Hartford—Hillside Co-operative Dairy Co., Route 4, E. C. Retzlaff, Purch. Agt.—power churns, separators and belting.

Wis., Madison—J. Feldman Paper Box Co., 515 Regent St.—special machinery for box factory.

Wis., Madison—Madison Gas & Electric Co., 120 East Main St., Mead & Seastone, Engrs., State Journal Bldg.,—Engineers are receiving bids for ash handling equipment for power house.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances.—Recent mill rise in blue annealed sheets reflected in advance of 12c. in Chicago and 25c. per 100 lb. in Cleveland warehouses. Floor plates up 25c. in Cleveland; steel bars and shapes, 2c. and bands, 12c. in Chicago. Steel shapes, plates and bars quoted at $1.70@$1.80 per 100 lb., Pittsburgh. Quotations at the lower figure, however, difficult to obtain even on large tonnages. On current business, as high as $1.90@$2 has been quoted on plates and $2 per 100 lb. on shapes.

Tin quoted at 33¼c. as against 32¼c. and zinc at 6¾c. as compared with 6 7/16c. per lb., last week. Brass sheets and tubing up ¼c.; brass wire and rods, 1c. and babbitt metal, ¼c. per lb. in New York warehouses. Babbitt metal up ¼c. in Cleveland. Copper market slightly firmer. Lead prices steady; sales heavier. Dealers' purchasing prices of old copper and zinc advanced slightly in Cleveland and Chicago.

Declines.—Drop of ¼c. per lb. in dealers' purchasing prices of old lead, in Cleveland. Raw linseed oil down 2c. per gal. (5 bbl. lots) in New York.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	26.52
Southern Ohio No. 2	26.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	28.32
Virginia No. 2	29.74
Basic	26.00
Grey Forge	26.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.50
Basic	25.50
Bessemer	25.50

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 40@2.60	3.78	3.50	3.75
No. 12	2.45@2.65	3.83	3.55	3.80
No. 14	2.50@2.70	3.88	3.60	3.85
No. 16	2.70@2.90	3.98	3.70	3.95
Black				
Nos. 17 and 21.	3.00@3.25	4.15	3.80	4.30
Nos. 22 and 24.	3.05@3.30	4.20	3.85	4.30
Nos. 25 and 26.	3.10@3.35	4.25	3.90	4.35
No. 28	3.15@3.40	4.35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11.	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	⅜ to 1¼	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	69	57½	⅜ to 1¼	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods(base)	7.00	8.00	6.85
Hoop steel	3.78	3.50	3.48
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	4.80	4.91	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.83	2.66	2.70
Soft steel bars (base)	2.73	2.56	2.60
Soft steel bar shapes (base)	2.73	2.56	2.60
Soft steel bands (base)	3.38	3.06	3.35
Tank plates (base)	2.83	2.66	2.38
Bar iron (2.20 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/16	8.00		12@13
¼	6.50		11@12
5/32 to ⅛	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	33.12½
Lead (up to carlots), St. Louis, 5.40; New York	6.00
Zinc (up to carlots), St. Louis, 6.00; New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	18.50	18.75
Brass tubing (100-lb. lots)	21.50	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	16.25	21.50	15.75
Brass wire (carlots)	18.25	17.75	.....
Zinc sheets (casks)	8.50	.....	.....
Solder (½ and ¼), (caselots)	23.00	22.00	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11. 12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J. .	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.00
Copper, heavy, and wire	11.75	11.50	11.25
Copper, light, and bottoms	9.75	9.75	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6 25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.15	1.01
White lead, dry or in oil	100 lb. kegs.	New York,	12.50
Red lead, dry	100 lb. kegs.	New York,	12.50
Red lead, in oil	100 lb. kegs.	New York,	14.00
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$10.50@11.00	
Coke, prompt foundry, Connellsville	per net ton	10.50@11.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65–10%	60%
1½ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	.....	$4.00 off
Button head bolts, with hex. nuts	25%	$3.90 net	.....
Hex. head and hex. nut bolts	30%	.....	65-5%
Lag screws, coach screws	50%	.....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50–5%
Bolt ends, with hot pressed nuts	50%	.....	55%
Tap bolts, (h. h. plus std. extra of 10%)	10%	.....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ¼ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$4.00	$3.25	$3.25
Cone heads, ditto (net)	4.10	3.35	3.35
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	....	1.40
Cloth	3.02	.....	3.20

Wis., Milwaukee—M. L. Buck, 2713 Grand Ave., (garage)—chain hoist similar to the kind used for machine shop work.

Wis., Milwaukee—New Way Service Co., 1627 North Ave., B. Adelman, Purch. Agt.—laundry machinery.

Wis., Oshkosh—Oshkosh Shirt Co., W. C. Bouck, Purch. Agt.—power stitching machines and electric motors.

Wis., Waukesha — Manitowoc Church Furniture Co., 1214 Lincoln Ave.—woodworking machinery for the manufacture of church furniture.

Wis., Waukesha—The Spring City Auto Co., 220 Main St., W.—gas storage tank and pump.

Wyo., Casper—The Texas Co., J. A. Wall, Purch. Agt.—equipment for 6,000 bbl. oil refinery.

N. B., St. Johns—Nasgwak Paper Mills Ltd.—machinery and equipment for paper mill addition.

Ont., Chatham—Sarnia Oil & Gas Co., L. A. Wilson, Dir.—machinery and equipment for proposed gasoline absorption plants in Western Canada, Northern Alberta.

Ont., Fort William—Fort William Paper Mills—machinery and equipment for proposed paper mill.

Ont., London—Sterilized Egg Ltd., 372 Maitland St.,—manufacturer of egg sterilizing equipment.—A. R. Routledge, Pres.—wood and metal working machinery for making special parts.

Ont., St. Thomas—Lorne Tractors, Ltd., H. Carmichael, West Lorne, Engr.,—wood and metal working machinery, tools and gasoline engines for tractors and parts.

Ont., Toronto—Durant Motors of Canada, 909 Royal Bank Bldg.—equipment for machine shop and for proposed automobile factory at Leaside.

Ont., Toronto—Taylor Rubber Co., 37 Richmond St., E.—colanders, moulds, and finishers for auto tire factory in Aurora.

Ont., Welland—Maple Leaf Milling Co., R. Cooper, Mgr.—flour milling machinery and equipment.

Ont., Windsor—Windsor Steam Motors, Ltd.,—complete machinery and equipment for proposed steam automobile plant.

Mex., Tampico—Pierce Oil Corp.—equipment for refinery partially destroyed by fire.

Metal Working Shops

Cal., San Francisco—W. P. Fuller Co., Beale and Mission Sts., has awarded the contract for the construction of a garage. Estimated cost $40,000.

Conn., Hartford—Greenwood & Noerr, Engrs. and Archts., 847 Main St., are receiving bids for the construction of a 4 story, 52 x 181 ft. factory, for the manufacture of electric specialties, for Hart & Hegeman Mfg. Co., Capitol Ave. Estimated cost $125,000.

Conn., Stamford—Frankel & Warshaw, 262 Atlantic St., are receiving bids for the construction of a 2 story, 85 x 90 ft. garage on State St. Estimated cost $40,000. S. Z. Levine, Gurley Bldg., Archt.

Ill., Evanston—C. C. Henderson, Archt., 105 South La Salle St., is receiving bids for the construction of a 1 and 2 story, 66 x 204 ft. garage at 1622-24 Chicago Ave., for J. E. Hebblethwaite, 1707 Ridge Ave. Estimated cost $40,000.

Ind., Indianapolis—Olin Sales Co., 515 North Meridian St., plans to build a 3 story, 59 x 195 ft. automobile sales and service station at 720-2 North Meridian St. Estimated cost $150,000. Architect not selected.

Mass., South Boston (Boston P. O.)—National Can Co., 36 Washington St., will soon award the contract for the construction of a 2 story, 92 x 160 ft. factory, a 3 story, 20 x 40 ft. storehouse, and a 1 story, 20 x 60 ft. garage, on Locust St. Estimated cost $125,000. Noted Apr. 13.

O., Cleveland—Cleveland Heater Co., 1905 West 112th St., is receiving bids for the construction of a 1 story, 30 x 240 ft. factory on West 112th St. and Locust Ave. Estimated cost $100,000. L. Friedman, Pres. G. S. Rider & Co., Century Bldg., Engrs. and Archts.

O., Cleveland—D. Round & Son, Stop 3, Bway., had plans prepared for the construction of a 2 story, 52 x 275 ft. foundry and shop. Estimated cost $50,000. H. W. Maurer, Schofield Bldg., Archt.

O., Cleveland—F. P. Screw Co., 2921 East 79th St., has awarded the contract for the construction of a 1 story, 25 x 160 ft. factory, at 2921 East 79th St. Estimated cost $40,000.

O., Cleveland Heights (Warrensville P. O.)—W. Van Bergan, Stop 14, Mayfield Rd., plans to build a 1 story, 74 x 109 ft. garage at 2204 Lee Rd. Estimated cost $45,000. Private plans.

Pa., Butler—Hinman Bros., 1017 7th Ave., have awarded the contract for the construction of a 2 story, 100 x 150 ft. garage on Green Ave. and 8th St. Estimated cost $60,000.

Pa., Freedom—Freedom Oil Wks. is having plans prepared for the construction of a 2 story, 48 x 75 ft. garage and repair shop addition. J. E. Martsolf, 513 3rd Ave., New Brighton, Archt.

Pa., Grove City—McKays Carriage Wks., Erie St.—manufacturer of automobile bus bodies and other carriages, has awarded the contract for the construction of a 1 story factory addition.—Estimated cost $10,000.

Pa., Hatboro—Roberts & Manders Stove Co., 11th and Washington Sts., has awarded the contract for the construction of a 2 story, 16 x 60 ft. and a 1 story, 125 x 185 ft. factory. Estimated cost $50,000. Private plans.

Pa., New Kensington—National Auto Service Co. has awarded the contract for the construction of a 1 story, 25 x 60 ft. and 60 x 70 ft. garage, at 1030 5th Ave. Estimated cost $40,00.

Pa., Osgood—Du Roth Steel Truck & Car Wheel Co., 611 Keystone Bldg., Pittsburgh, plans to build a manufacturing plant here, the first unit to be 100 x 200 ft. Estimated cost $1,500,000. C. E. Long, 1202 Peoples Bank Bldg., Engr.

Pa., Phila.—National Biscuit Co., 10th Ave. and 15th St., New York City, has awarded the contract for the construction of a 1 story, 130 x 184 ft. garage on 12th and Glenwood Sts., here. Estimated cost $50,000. A. G. Zimmerman, 85 9th Ave., New York City, Archt.

Pa., Pitcairn—Pennsylvania R. R., Broad St. Sta., Phila., is having plans prepared and will soon receive bids for the superstructure of a steel car repair shop, here. Estimated cost $300,000. A. C. Shand, Ch. Engr.

Pa., Pittsburgh—Commercial Land Co. c/o F. M. Love, 235 Water St., is receiving bids for the construction of a 4 story garage on Rebecca St. and Baum Blvd. Estimated cost $175,000. Private plans. Buick Motor Co., Baum Blvd. and Euclid Ave., lessees.

Pa., Pittsburgh—Hunting Davis Co., archts., Century Bldg., is receiving bids for the construction of a 1 story, 41 x 108 ft. garage addition for T. Donaldson, c/o Donaldson McAleer Motor Co., 1100 Western Ave.

Pa., Pittsburgh—W. H. Stulen, Archt., 101 Market St., is receiving bids for the construction of a 2 story, 34 x 115 ft. factory addition, for the manufacture of toys, for D. N. Carlin Co., 125 Denniston Ave. Estimated cost $20,000.

Pa., Warren—Warren Tank Car Co. will rebuild its tank car factory and repair plant destroyed by fire. Estimated cost $75,000. Private plans. Noted June 22.

Pa., Waynesboro—The Frick Co., (steam engine and boiler works), will build a 1 story, 300 x 600 ft. addition to its plant. Private plans. Noted Mar. 24.

Tenn., Knoxville—Iddens Mchy. Co. will soon receive bids for the construction of a 1 story plant. Estimated cost $50,000. Architect not announced.

W. Va., Beckley—The Raleigh Motor Co. is having plans prepared for the construction of a 3 story, 49 x 146 ft. garage on East Main St. Estimated cost $60,000. H. M. Miller, Roanoke, Va., Archt.

W. Va., Wheeling—The McGraw Co. (Ford Agency), Bellaire, O., is having plans prepared for the construction of a 2 story, 85 x 125 ft. garage at 2011 Main St., here. Estimated cost $40,000. Architectural Dept. of Ford Motor Co., Detroit, Mich., Engrs.

Wis., Appleton—Hermann Motor Co., 680 College Ave., plans to build a 2 story, 80 x 80 ft. garage and repair shop on College Ave. Estimated cost $40,000. Architect not selected.

Wis., Black Earth—R. A. Hermann plans to build a 1 story, 50 x 70 ft. garage on Main St. Estimated cost $40,000. Architect not selected.

Wis., Nekoosa—Nekoosa Iron Wks. will build a 1 story, 50 x 75 ft. machine shop and foundry. Estimated cost $40,000. M. J. Powers, Pres.

Wis., Waukesha—The Spring City Auto Co., 220 Main St., W., is receiving bids for the construction of a 1 and 2 story, 50 x 132 ft. garage. Estimated cost $40,000. M. H. Blake, Andrews Blk., Archt. Noted June 8.

Ont., Leaside—Durant Motors of Canada, 909 Royal Bank Bldg., Toronto, is receiving bids for the construction of an auto factory including a 1 story 40 x 100 ft., 3 story 80 x 401 ft., 3 story 100 x 401 ft., 1 story 20 x 200 ft. and 1 story 130 x 500 ft. buildings, here. Estimated cost $500,000. Private plans.

General Manufacturing

Cal., Oakland — General Electric Co., Rialto Bldg., San Francisco, has awarded the contract for the construction of a 132 x 236 ft. factory on 14th and 54th Sts., here. Estimated cost $100,000.

Conn., Essex—E. E. Dickenson & Co. has awarded the contract for the construction of a 3 story, 40 x 100 ft. addition to its witch hazel plant. Estimated cost $40,000. Noted June 29.

Conn., Hartford—The Hartford Ice Cream Co., 380 Windsor Ave., is receiving bids for the construction of a 2 story, 40 x 80 ice cream plant.—Estimated cost $30,000. Private plans.

Fla., Auburndale — Auburndale Citrus Growers Assn. has awarded the contract for the construction of a 1 story 80 x 125 ft. packing plant. Estimated cost $18,000. E. B. Sands, Mgr.

Ill., Chicago—W. F. Hall Co., Chicago and Kingsbury Sts., plans to build a printing plant, (in units), on Kilpatrick between Diverse and Wellington Sts. Estimated cost $8,000000. Architect not announced.

Ill., Chicago—Henschien & McLaren, Archts., 1637 Prairie Ave., will soon receive bids for the construction of a 4 story, 75 x 150 ft. packing plant near the Union stock yards, for the Western Packing & Provision Co., 3854 South Morgan St. Estimated cost $170,000.

Ind., Anderson—National Tile Co., 25th and Pitts Sts., has awarded the contract for the construction of a 1 story, 85 x 435 ft. tile plant. Estimated cost $50,000.

Me., Lewiston—The Lewiston Bleachery & Dye Wks., Lisbon St., has awarded the contract for the construction of a 3 story, 40 x 110 ft. addition to its sheeting department.—Estimated cost $40,000. Private plans.

Minn., Duluth — McDougall Terminal Warehouse Co., 510 Alworth Bldg., has awarded the contract for the construction of a 6 story 200 x 500 ft. refrigerating plant and terminal warehouse on Railroad St. and 9th Ave., W.—Estimated cost $1,000,000. A. M. McDougall Pres.

Minn., Minneapolis—Western Newspaper Union, 200 North 3rd St., has awarded the contract for the construction of a 2 story, 46 x 134 ft. printing plant and office building at 316 8th Ave. S. Estimated cost $125,000.

O., Cleveland—Glenville Hospital c/o A. White, Supt., 701 Parkwood Dr., will soon award the contract for the construction of a 1 story, 36 x 50 ft. laundry. Estimated cost $50,000. J. W. C. Corbusier, 1038 Keith Bldg., Archt.

O., Zanesville—Kerns Gersuch Bottle Co. has awarded the contract for the construction of a 1 story, 24 x 40 ft. factory. Estimated cost $100,000.

Pa., Phila.—Apex Hosiery Co., Lawrence & Luzerne St.—has awarded the contract for the construction of a 6 story, 90 x 155 ft. factory.—Estimated cost $150,000. Private plans. Noted Jan. 20, 1921.

Pa., Phila.—E. I. DuPont Paint Co., 35th St., and Grays Ferry Rd., will build a 1 story, 63 x 113 ft. factory.—Estimated cost. $12,000. Private plans.

Pa., Pittsburgh—The Pittsburgh Forge & Iron Co., Chamber of Commerce Bldg., plans to build a 1 story, 26 x 54 ft. carpenter shop on 26th St. W. G. Wilkins Co., Westinghouse Bldg., Archts.

Pa., West Hickory—H. H. Smith & Co., will rebuild its 3 story, 68 x 72 ft., and 50 x 140 ft. tannery and bleach house which was destroyed by fire. Estimated cost $50,000. Noted June 29.